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frontispiece

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
MARION B. FOLSOM, *Secretary*

PUBLIC HEALTH SERVICE
LEROY E. BURNEY, *Surgeon General*

ASIAN VARIANT INFLUENZA TYPE A

In the fall of 1957 the United States experienced the most extensive influenza epidemic in 40 years. This, in itself, is a historical event of major medical and public health significance. Equally significant is the fact that for the first time in our history the Nation was making real preparations for an epidemic before it appeared.

Although morbidity and mortality rates, as was predicted, did not equal those of the 1918 pandemic, we shall never know, precisely, the total who were incapacitated or the real impact on the national economy. That it was substantial is indicated by the samplings taken by the U. S. National Health Survey, which showed that more than 80 million Americans suffered from illness of the upper respiratory tract between July 1 and December 1, 1957, of such severity that they had to spend one or more days in bed. While all of these cases were obviously not Asian influenza, it is reasonable to assume that the illness accounted for the majority.

At the time at which this is written—in late December—it would appear that the epidemic has pretty well run its course in the United States. Opinion differs on the possibility that by the time this appears we may be experiencing a second wave; and a substantial amount of Asian influenza is anticipated during the midwinter months.

The fairly rapid decline in new cases during late November indicated that the first wave was over; and that the time was appropriate for a provisional summing up of our national experience with this epidemic.

Historical perspective will provide more definitive conclusions than are reached in the following pages. The story as it is here recorded, however, will be of interest to the public health profession and may well suggest guidelines for meeting similar health problems in the future.

To me, one of the most significant things about our national experience has been the demonstration of how quickly and effectively our national medical and health resources can mobilize to combat the threat of nationwide illness. The keynote of the whole program, in fact, has been the cooperation of the many toward a single goal. I do not know of another instance in our peacetime history in which so many of the elements of our society, in so short a time, have joined together to identify a health problem, determine the means for its solution, and to work toward resolving it.

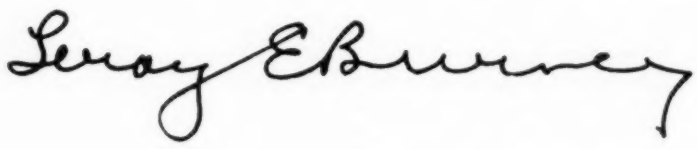
These elements have included the agencies of the Federal, State, and local governments, notably, the Department of the Army, which first isolated and identified the Asian influenza virus, the medical and public health profession, professional societies, the voluntary health agencies, the pharmaceutical manufacturers, advertising, and, in full measure, the press, television, and other media of professional and public information and education.

Throughout this report, the contributions of these groups and others are noted. It is not inappropriate to extend to all of them and to the hundreds of individuals who have worked on the problem, a word of appreciation on behalf of their fellow Americans.

I mentioned earlier the statistics of incidence. Certainly it was substantial. The rapid production and distribution of the vaccine during the fall months, however, unquestionably reduced the impact of the epidemic. Many millions of persons, we can be certain, did not contract Asian influenza because of the protection of the vaccine.

This issue of *Public Health Reports* includes a report on the Asian influenza epidemic and the steps taken to study and control it. The report suggests, among other things, that the profession and structure of public health are stronger as a result of our experience with the Asian influenza epidemic of 1957.

More important, it provides a document which, under study, may yield knowledge on how we can do a better future job for the people of the Nation in whose cause we serve.



WILLIAM H. STEWART, M.D.

THE ASIAN INFLUENZA program of the Public Health Service, at this writing, would appear to fall, chronologically and functionally, into four phases. The first, a period when information was received and policy issues were broadly delineated, began in the spring of 1957 and ended with the first meeting of the Surgeon General's Advisory Committee on Influenza on June 10.

As the disease occurred sporadically in the United States during the summer, the Public Health Service deployed its resources to maintain surveillance, conferred with manufacturers on problems of vaccine production, determined the requirements of alternative courses of action, and secured the cooperation and financial support necessary to institute the program finally adopted. This developmental phase, as it may be characterized, came to an end late in August.

Dr. Stewart, Assistant to the Surgeon General, has served as liaison for the influenza activities of the Office of the Surgeon General, Public Health Service.

On August 27–28, 1957, the State and Territorial health officials met in Washington at the request of the Surgeon General. The virus was then widely seeded across the Nation, the licensed influenza vaccine manufacturers were in full-scale production, and the medical, hospital, and public health authorities of the Nation, through their professional organizations, had made plans to mobilize their resources in the event of a large-scale epidemic. After reviewing this progress, the health officers concurred in the decisions taken and called for further specific action by the States and the Public Health Service.

We are currently in the operating phase of the Asian influenza program, a phase perhaps drawing to a close. At some time in the spring of 1958, a year more or less after Asian influenza was first reported, the retrospective evaluations will begin. This fourth and final phase may well be lengthy, for the Asian influenza episode is unique in the history of public health and deserves the thoughtful consideration it is certain to receive from students of

medicine, epidemiology, virology, immunology, public health administration, and health education.

This chronicle records administrative aspects of the Asian influenza program of the Public Health Service, from the viewpoint of the Office of the Surgeon General. It will deal only with the first two periods categorized above, the administrative problems of the latter two phases being relatively commonplace. Administrative issues presented in the early months of the program, however, were unprecedented and therefore require elucidation.

Nation Alerted

As is well known, the initial laboratory work on the Asian influenza virus was performed, with exemplary initiative and speed, by the Army: the 406th Medical General Laboratory in Japan and the Walter Reed Army Institute of Research in Washington, D. C. The results of this work were communicated at once by the Army virologists to their counterparts in the Public Health Service, with whom they are in continuing close professional contact. The situation first came to the attention of the Office of the Surgeon General on May 20, 1957, when the director and an associate director of the National Institutes of Health reported orally to the Acting Surgeon General that epidemic influenza with unusually high attack rates was being reliably reported from Asia.

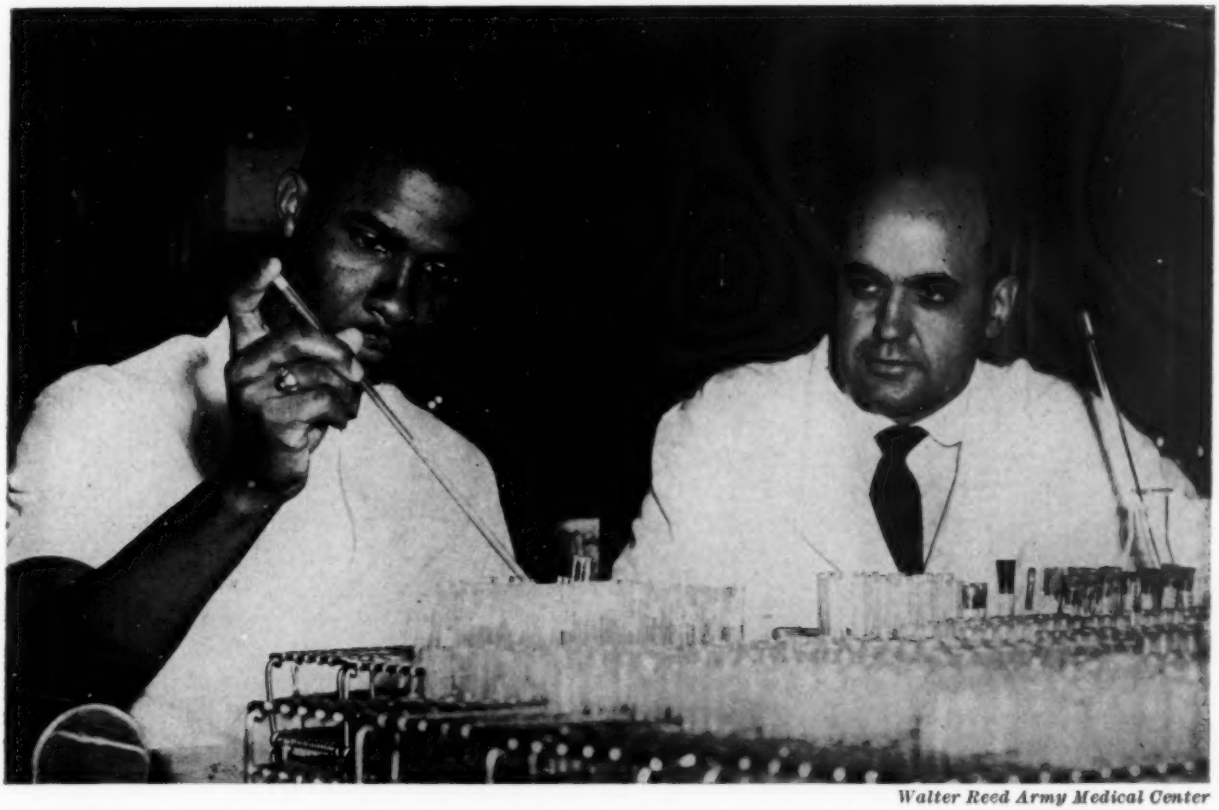
The Deputy Surgeon General, who was at this time acting head of the Public Health Service because the Surgeon General was in Geneva at a World Health Organization meeting, designated the associate director of the National Institutes of Health, a virologist, as technical point of contact for the Surgeon General with respect to the developing influenza situation. The Acting Surgeon General next informed the Assistant to the Surgeon General for Information and designated a medical officer to maintain special liaison with the Institutes.

On May 22, the National Office of Vital Statistics submitted a memorandum summarizing reports of the spread of the disease. During that first momentous week, the staff of the Special Assistant for Health and Medical Affairs to the Secretary was being kept apprised of the situation. From the National Institutes of Health came a report of a "dry run" exercise in vaccine production conducted by the manufacturers with the "London" strain in 1951, as well as a memorandum from the director of the Division of Biologics Standards outlining the technical steps that must precede mass immunization with a new vaccine. More specific information with respect to potential vaccine production was requested from the National Institutes of Health.

When the bureau chiefs met for their regular staff meeting with the Office of the Surgeon General on May 28, the Army had supplied Asian strains of the influenza virus that were not compatible with previously known strains. The National Institutes of Health had made the new strains available to licensed vaccine manufacturers, in accordance with established procedure, so that they could prepare to incorporate them in the polyvalent influenza vaccine then being produced, if this were deemed desirable.

The Acting Surgeon General recalled that when the Armed Forces began routine annual influenza immunization in 1954, the Public Health Service did not recommend comparable immunization of the general public. This decision was rooted in the relatively short duration of demonstrated immunity and lack of assurance that strains in the polyvalent vaccine would be the ones responsible for future epidemics. However, the Acting Surgeon General now believed it necessary to reexamine, in the light of later developments, the bases of Public Health Service policy on immunization of civilians against influenza. The Bureau of State Services and the National Institutes of Health were therefore asked to confer and to forward an analysis and recommendations.

Formal Public Health Service participation in the national common effort began on May 28 at a conference called at the requests of the chiefs of preventive medicine of the three military services to consider the control of influenza caused by the new strain of virus which had been first reported from Hong Kong on April 17. The Public Health Service was rep-



Walter Reed Army Medical Center

At the Walter Reed Army Institute of Research, Dr. Maurice R. Hilleman (right), who first identified the Asian influenza virus as a new strain of type A, observes as Pfc. Virgil Ewing tests the immunological response of the new vaccine developed against the virus.

resented by an associate director of the National Institutes of Health and the director of its Division of Biologics Standards.

The conference was informed that the disease was clinically mild with high attack rates on naval vessels and among civilians. Laboratory evidence indicated that the virus responsible was, for practical purposes, antigenically new; antibodies to it were absent in both animals and humans who had been highly immunized naturally or artificially against preceding strains of influenza virus. The virus had already reached the United States, in the opinion of the group, but the disease was not expected to reach major epidemic proportions until fall.

The conference recommended to the military Surgeons General that the Department of Defense procure about 3 million cubic centimeters of a monovalent vaccine containing the Hong Kong strain of the virus, the desired strength of this vaccine being tentatively set at 500 CCA units. September 1 was the target date recommended for the start of the vaccination program for military personnel. The Commission on Influenza of the Armed Forces Epidemiological Board was requested to propose as quickly as possible the composition of a polyvalent influenza virus vaccine to be used later in the year.

On May 29, the associate director of the National Institute of Allergy and Infectious Diseases forwarded a memorandum describing the Influenza Study Program of the World Health Organization and mentioning the probable need for an increase in the number of collaborating laboratories in the United States and for providing them with diagnostic reagents for detection of the Asian influenza virus. The director of the National Institutes of Health also submitted a memorandum, after consultation with the chief of the Communicable Disease Center, recommending that the monovalent vaccine desired by the Defense Depart-

ment be licensed; that the Communicable Disease Center furnish typing antiserums to State laboratories; that State epidemiologists be advised to watch for outbreaks of Asian influenza; that the Epidemic Intelligence Service of the Communicable Disease Center promptly investigate reported outbreaks; and that "the role of influenza vaccine as a public health measure be carefully studied . . . ."

The chief of the Division of Foreign Quarantine also forwarded a memorandum to the Office of the Surgeon General on May 29. It advised that quarantine officers at Honolulu, Seattle, San Francisco, and Los Angeles were inspecting inbound traffic for influenza signs and symptoms and notifying health officials of their occurrence. Passengers were being asked their itineraries for 2 weeks before and after quarantine inspection, with notification of local and State health departments following when indicated.

After reviewing these documents, the Acting Surgeon General met with the Assistant to the Surgeon General charged with special influenza responsibilities and the deputy chief of Information Services. It was decided to call the Bureau of State Services and the National Institutes of Health representatives together for more collaborative analyses and recommendations than had yet been presented. The information function was represented at this stage because of the public's obvious "need to know" about the nascent influenza policies.

Two days later, on May 31, the Acting Surgeon General wrote: "Nothing about influenza is more certain than that new strains appear, presumably by mutation, and epidemiologists have postulated that the 1918 pandemic was the result of such a mutation and that another pandemic may arise at any time from the same phenomenon. The question then is simply whether the current situation is sufficiently unusual to indicate the possibility that this has occurred. This decision requires careful consideration by the epidemiologists. If it [the current situation] is unusual or almost unique, the burden of proof would seem to be on those who oppose the recommendation to press for a mass immunization against the new strain with all possible vigor." The Acting Surgeon General then requested the principal staff officers to consider whether "the investment of the few million dollars necessary to develop and disseminate vaccine as widely as possible would be a logical step to recommend . . . if the current influenza situation was indeed unusual . . . [with] even a possibility of a widespread epidemic next fall."

Broad Planning

On the afternoon of May 31, officials of each bureau met with an Assistant to the Surgeon General to plan Public Health Service action with respect to Asian influenza. The conferees discussed coordination of Public Health Service activities, improvement of arrangements for influenza reporting, and influenza vaccine as a public health measure. The problems of producing a monovalent vaccine were compared with those of producing a polyvalent vaccine containing the new strain. The lack of comprehensive data dealing with effectiveness of influenza vaccines among the civilian population was noted.

The Division of Foreign Quarantine was asked to work closely with the Epidemic Intelligence Service of the Communicable Disease Center and to report all relevant information promptly to the National Office of Vital Statistics. The Communicable Disease Center was asked to alert State health departments and laboratories, intensify its influenza surveillance, and report its findings to the National Office of Vital Statistics, from whence information would be disseminated biweekly to all concerned in the Service and elsewhere. Announcement of the steps that were being taken would be released to the press on June 3 and an article alerting physicians prepared at once for the *Journal of the American Medical Association*. Meanwhile, the National Institutes of Health would continue work on problems of vaccine production. It was agreed that more time was needed to observe the course of the epidemic and progress in producing vaccine before it would be possible to give a mature judgment on the question of influenza immunization for the general public.

On June 5 the Division of Foreign Quarantine reported influenza aboard a civilian ship bound for San Francisco from the Orient. The Office of the Surgeon General was also advised

that inquiries had already been received from other Federal agencies and transportation lines concerning Service policy on use of the polyvalent influenza vaccine then available in small quantities through commercial channels.

Questions of this nature were discussed that day at a meeting called by the Assistant to the Surgeon General designated to deal with Asian influenza. Representatives of all bureaus were present. The associate director of the Institutes stated that the odds favored a mild epidemic in the fall or winter, but that there was some possibility of an epidemic on the order of the 1918 experience. The technical problem of vaccine production had been solved, he reported; a monovalent vaccine could be expected in September and a polyvalent vaccine incorporating an Asian strain a month later. Monovalent vaccine production had been started with purchases by the Department of Defense.

He suggested that certain groups, such as transportation, communications and utility workers, hospital personnel, and some Federal employees, receive the monovalent vaccine as soon as the Armed Forces. (A list of proposed civilian occupational priorities for vaccination against influenza had been prepared as part of the 1951 exercise.) These actions would not require additional funds. The deputy chief of the Bureau of State Services proposed that the Surgeon General seek the counsel of an advisory group representative of public health officials, practicing physicians, and the vaccine manufacturers. He foresaw advocacy by the Public Health Service of large-scale immunization, under certain conditions, and this would require additional expenditures.

The members of this meeting thereupon recommended that the Surgeon General confer with a representative professional group to ascertain its reaction to proposed recommendations by the Service that influenza vaccine be used generally in the civilian population and that certain special groups receive the monovalent vaccine as soon as it became available. No additional funds were believed necessary for these influenza activities. The advisers were to be told, however, that if the virulence of the virus increased or if the influenza case fatality rate turned upward, the Service would attempt to accomplish vaccination of all civilians. Authority to divert funds would be requested in this unlikely event, and supplemental funds would be requested to replace any so diverted.

There was, of course, considerable correspondence and informal liaison with congressional committee staffs and with offices of individual Senators and Representatives throughout the period described in this report. In reply to many inquiries, on June 7, after his return to the United States, the Surgeon General wrote to the chairmen of the committees and subcommittees of the House of Representatives and the Senate which are responsible for substantive and appropriations legislation for the Public Health Service. He advised them of the developing situation and furnished a summary of events and actions taken, including an announcement of a meeting on June 10 of a special advisory committee of physicians and health officers.

The Advisory Committee on Influenza, which first met on June 10, included the secretary of the Executive Committee and the chairman of the Civil Defense Committee of the Association of State and Territorial Health Officers; the president of the Academy of General Practice and a member of the board of trustees of the American Medical Association; representatives of the American Public Health Association and the American Academy of Pediatrics; the director of the Commission on Influenza, Armed Forces Epidemiological Board, and a spokesman for the Division of Preventive Medicine, Office of the Surgeon General of the Army; and the Special Assistant for Health and Medical Affairs, Office of the Secretary of Health, Education, and Welfare. Officials of the Service with influenza responsibilities also attended, as well as a representative of the Children's Bureau.

General findings of the meeting were:

1. No major outbreaks were expected to occur before fall, although sporadic occurrence could be expected throughout the summer.

2. Since limited information suggested that the existing polyvalent vaccine was not effective against the new influenza virus strain, an effective monovalent vaccine should be produced as soon as possible.

3. Every effort should be made to test vaccines and to collect, study, and disseminate

information on the epidemiology of Asian influenza. Consideration should be given, but based on later and more complete information, to the use of a vaccine by the civilian population.

4. No change should be recommended in private physicians' practice in utilizing the existing polyvalent vaccine. Physicians should immediately report suspicious cases to their health departments so that any occurrence of suspected influenza could be investigated quickly.

5. The situation did not yet appear to justify establishment of priorities for civilian use of the vaccine or consideration of government subsidy in its production.

The gist of these findings was telephoned on June 10 to the regional medical directors, who were directed to telephone the same information to the chief State health officials in their region. The Surgeon General had directed that the States be kept fully informed with all possible speed. To this end, among other measures, the chief of the Bureau of State Services frequently telegraphed State health officials during the summer to alert them to influenza information in the *Morbidity and Mortality Weekly Report* and to report other developments.

After the meeting of the Advisory Committee on Influenza, the Surgeon General held a general press conference. (He and other members of his staff were accessible to individual reporters throughout the period described.) Interest of the press and public in influenza rose sharply as a result. The voluntary health organizations were immediately alert to the various eventualities inherent in the situation. On June 11, the managing director of the National Tuberculosis Association, for example, generously offered the cooperation of the association and its affiliates for the health education of the public, if this should become necessary. Similar messages were received from other large voluntary health and welfare associations and professional societies.

Tempo Intensified

The June 10 meeting, as has been noted, marked the end of the first phase of the Asian influenza activities of the Public Health Service. After that meeting, the tempo of those activities increased markedly, as outbreaks of the disease increased across the Nation and as the time approached for decision on the major policy issues. As recognized on June 10, these were:

1. Whether to recommend vaccination and of what segments of the population.

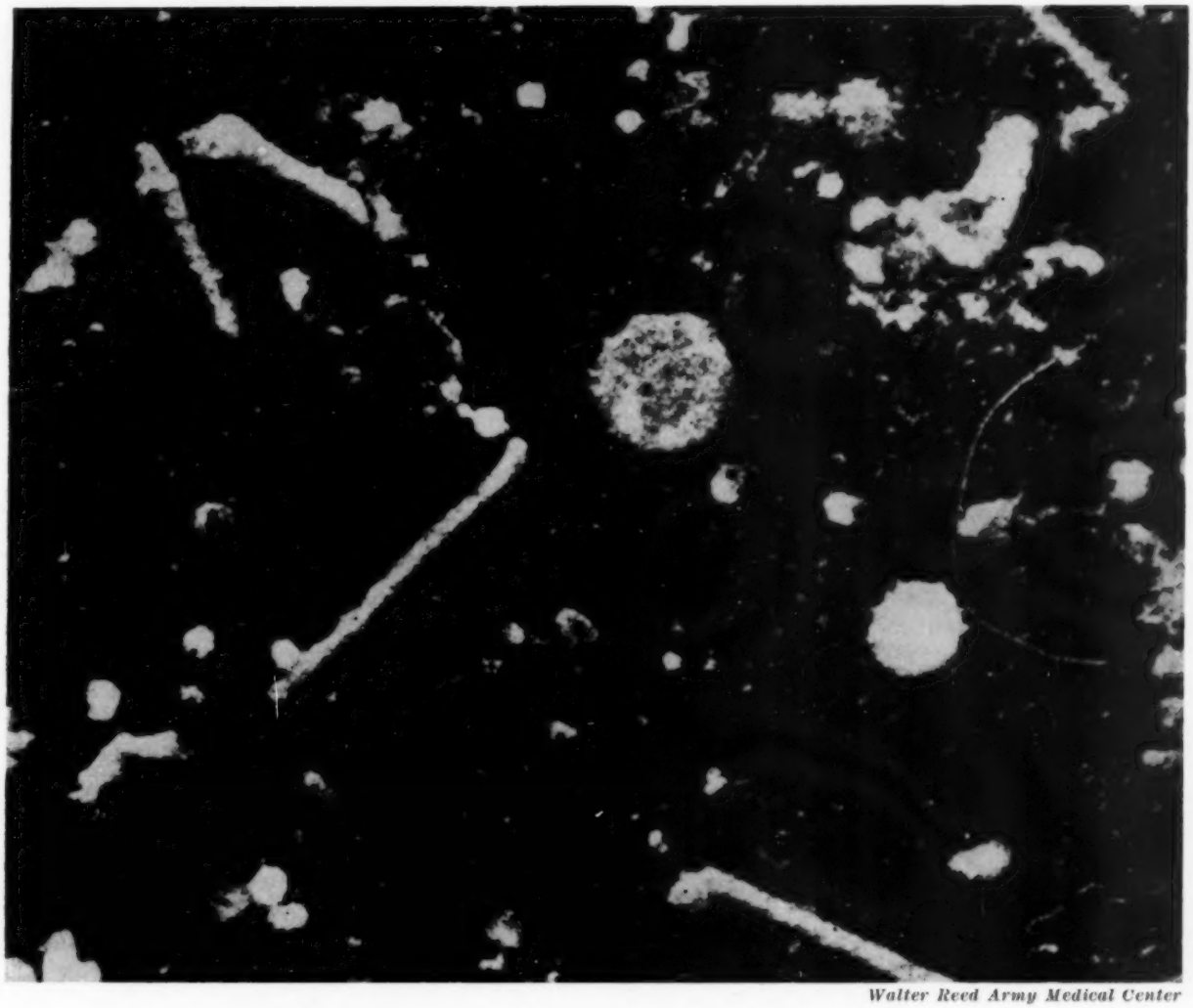
2. Whether to rely on a monovalent or polyvalent vaccine, a complex question related to factors of effectiveness and supply.

3. The extent of further Public Health Service participation in influenza programs.

The second or developmental phase of Public Health Service Asian influenza activities opened with a meeting on June 12 of technical representatives of the vaccine manufacturers with the National Institutes of Health. The latest epidemiological information was presented to the manufacturers, with data on the influenza virus strains encountered and their growth characteristics. Each firm summarized its experience with the growth of the various strains used in the production of influenza vaccine.

The proposed strain constitution of vaccines for military and civilian use was then discussed. The proposed formulas for military monovalent and polyvalent vaccine caused no comment, but some discussion concerned the proposed polyvalent vaccine for civilian use. The manufacturers expressed a preference for a monovalent vaccine containing the Asian strain. There was general agreement that the low antigen yield of the Asian strain as measured in CCA units made it difficult to obtain material of sufficient concentration for inclusion in the proposed polyvalent vaccine. It was pointed out that much of the vaccine prepared for the coming influenza season had already been pooled, and the Asian strain could not be added because it could not be produced in high concentration. In view of this difficulty, each manufacturer agreed to review its inventory and submit as quickly as possible an evaluation of the formula that would make best use of the material at hand.

By June 17 the special weekly influenza report to the Surgeon General brought word of potency studies of monovalent vaccines conducted by the Virus and Rickettsia Section,



Walter Reed Army Medical Center

Electron microscope photograph of Asian influenza virus.

Communicable Disease Center, Montgomery, Ala. Such studies are essential for standardization of vaccines. The reactivation of the Inter-Service Influenza Advisory Committee, which had been recommended at the June 10 meeting, was also reported. The Armed Forces Epidemiological Board, the National Institutes of Health, and the Communicable Disease Center each planned to have an epidemic intelligence team ready on short notice to investigate influenza outbreaks anywhere in the world. The Division of International Health of the Public Health Service and the Regional Office of the World Health Organization made arrangements to facilitate the rapid departure of these standby teams. It will be recalled that at that time no isolation of the Asian strain had yet been made in the United States. It was therefore important to learn as much as possible from epidemics abroad, looking especially for evidence of increased virulence.

The first report of Asian influenza in the United States came from the Navy by telephone on June 18. Aboard ships at the Naval Station at Newport, R. I., none of which had been in Far Eastern waters, the disease was running a course similar to that reported from the Orient and elsewhere.

Countering All Eventualities

On June 20 an Associate Director of the National Institutes of Health set down the following alternatives for the course of the disease and corresponding action to counter each:

1. *An explosive epidemic before September 1, 1957, with either (a) continued low mortality, or (b) increased virulence.*

Vaccination could not be considered, except for limited supplies of polyvalent vaccine and possible production for use in 1958.

A professional and public information program and mobilization of medical resources, both in cooperation with the American Medical Association, would be imperative.

Expansion of epidemic intelligence and diagnostic laboratory networks would be essential.

2. *Sporadic local occurrence during the summer with an explosive epidemic during the winter, again with*

(a) continued low mortality.

Vaccination of priority groups, as many as 6 million people, would be indicated.

A professional and public information program and mobilization of medical resources, both in cooperation with the AMA, would be imperative.

Expansion of epidemic intelligence and diagnostic laboratory networks would be essential.

(b) increased virulence.

Maximum vaccine production and immunization would be required, with priority groups vaccinated first.

A professional and public information program and mobilization of medical resources, both in cooperation with the AMA, would be imperative.

Expansion of epidemic intelligence and diagnostic laboratory networks would be essential.

3. *Sporadic local occurrence during the summer with a winter of normal influenza incidence.*

No recommendation of influenza vaccination would be indicated.

Expansion of epidemic intelligence and diagnostic laboratory networks would still be essential.

The appropriate staff members were directed to develop the personnel, financial, and legislative requirements of these alternatives.

The logical possibilities set down in this form represent the alternatives then facing the decision-makers in the Public Health Service and elsewhere. The consensus in the Public Health Service during the middle of June was that the most probable outcome would be sporadic local occurrence during the summer with an epidemic during the fall or winter that would result in a relatively small increase in mortality. A widespread epidemic before Labor Day with low mortality was considered a reasonable possibility, but the odds against this event were believed to be greater than those favoring a benign epidemic later.

The hypothesis that the Nation would experience a winter of normal influenza incidence was considered wishful thinking. On the other hand, a repetition of the notorious pandemic of 1918 was also considered most unlikely, with probabilities of 1 in 20 to 1 in 40 against such an event. It could not be overlooked, however, that, historically, pandemic influenza of high mortality has recurred at intervals of about 20 years, and there had been no such experience for 39 years.

It was clear at this time that quantities of potent vaccine sufficient for large-scale immunization could not be anticipated until after the middle of August. If an epidemic occurred before Labor Day, with either mild or extreme mortality, there would be virtually no vaccine available. If the epidemic developed during the fall and winter, as seemed most probable, it would be possible to immunize a substantial segment of the population, provided that vaccine production was at a high level during the summer and fall. This would assure continuity of essential civilian services and protect those vaccinated against the discomfort and danger (relatively high for aged persons and those with a history of chronic respiratory or cardiac disease) of an attack of influenza. Production of large quantities of vaccine was also indicated to protect against the possibility of increased virulence of the Asian strain.

The framework of alternatives and the reasoning described above was presented to the Secretary of Health, Education, and Welfare on June 24, with preliminary estimates of probable cost of each possibility and new legislative authority that might be needed. On June 26 the Surgeon General met with representatives of the American Medical Association to describe the progress of the disease toward this country and discuss the question of medical manpower in the event of a serious epidemic. The outlook for immunization against influenza was also discussed, and the alternative types of Federal action envisaged by the Service were described. It was made clear that the situation did not appear to warrant large-scale vaccine purchases or subsidization of production by the Government. Agreement was then reached on the conduct of a joint Public Health Service-American Medical Association cam-

paign of public information and health education. News of Asian influenza was on the front pages and television screens, but the public had not learned what it could do to protect itself. The association was represented at this meeting by two trustees, the chairman of the Committee on Civil Defense and the assistant secretary-general manager.

On the next day the National Institutes of Health reported plans for research on influenza that would take advantage of the unique opportunities expected during the 1957–58 season. These plans included clinical studies of patients experiencing epidemic influenza, with particular emphasis on cardiovascular and systemic manifestations; studies of the factors contributing to elevated influenza mortality among aged or debilitated patients; and studies of the disease among vaccinated civilian communities. Not only was it possible to support these research projects with funds previously made available, but no additional funds were requested by the National Institutes of Health for its influenza vaccine studies, microbiological studies of patients with influenza, or laboratory studies and normal statutory control of vaccine production.

On July 1 the Surgeon General's weekly memorandum to the Secretary's Special Assistant for Health and Medical Affairs reported a number of civilian cases in the United States that were believed to be Asian influenza, although it had not been possible to obtain laboratory confirmation of the tentative diagnoses. Influenza diagnostic reagents had been shipped to all domestic laboratories in the WHO Influenza Program, however, and improvement in the reporting of confirmed cases was expected. Advices from abroad indicated that morbidity and mortality rates were unchanged.

On July 2 officials of the Bureau of State Services and the Bureau of Medical Services discussed the possibility of an influenza outbreak at the International Boy Scout Jamboree to take place at Valley Forge, Pa., July 12–18. More than 50,000 Scouts were expected from all parts of the Nation and abroad. Physical examinations were to be made on arrival, a satisfactory physician-Scout ratio would exist, and as many as 25,000 hospital beds could be furnished in the vicinity by military, private, and Federal Civil Defense Administration hospitals, if an epidemic should develop. In addition to the Public Health Service, military, Scouter, and local civilian physicians, representatives of the State health department, and CDC Epidemic Intelligence Service officers were to be on the scene. These precautions were considered sufficient. During the Jamboree a few hundred Scouts were hospitalized because of upper respiratory infections, but this was not much more than normal incidence, in the opinion of the chief medical officer for the encampment, a physician from the PHS Hospital, Stapleton, N. Y. Confirmed cases of Asian influenza were largely confined to Scouts from California and Louisiana.

On July 3 the director of the National Institute of Allergy and Infectious Diseases was designated the "focal point" at the National Institutes of Health for influenza matters. NIH influenza research and licensing responsibilities involved the National Institute of Allergy and Infectious Diseases, the National Heart Institute, the National Institute of Mental Health, the National Institute of Neurological Diseases and Blindness, the Division of Biologics Standards, the Division of Research Grants, and the Clinical Center.

Confirmed Civilian Cases

Word came from the California State health officer on July 9 that laboratory results indicated Asian influenza as the cause of an outbreak of acute respiratory illness that had affected 200 teen-agers meeting at Davis, Calif., late in June. These were the first confirmed civilian cases of Asian influenza in the United States. Another outbreak then under investigation involved young people from 43 States and 10 other countries who had gathered at Grinnell, Iowa. Asian influenza was later proved in the laboratory to be responsible for this outbreak also, and it was further established that one of the young people at the Davis meeting afterward attended the Grinnell gathering.

An assistant to the Surgeon General met with officials of the American Medical Association in Chicago on July 9 to discuss recommenda-

tions with respect to influenza that were then being drawn up for action by the trustees of the association. The activities discussed at this meeting and later authorized by the trustees included professional information and education through the AMA publications, preparation of public information materials (in cooperation with the Public Health Service) for use when necessary, and standby plans by State and county medical societies to deal with serious epidemics.

On July 9 the Communicable Disease Center issued the first of a series of weekly reports summarizing laboratory information and epidemiological data reported by State health departments, Epidemic Intelligence Service officers, collaborating influenza diagnostic laboratories, and other sources.

On July 10 the Service announced establishment of specifications for manufacture of vaccines containing the Asian strain. On the same day the Executive Committee of the Association of State and Territorial Health Officers met in Washington, D. C., with Service officials. Influenza was discussed at length, with the Service urging more complete reporting from local sources and full utilization of laboratories for definitive diagnosis of the disease. The health officers agreed that the Public Health Service and the American Medical Association should conduct a vigorous campaign of public information and health education urging immunization against influenza. In the past, influenza vaccines had been used, for the most part, by large firms for the protection of their employees. However, the potential dangers accompanying a large-scale epidemic, which now appeared highly probable, made it advisable to stimulate wider use of the only preventive available.

On July 11 the Public Health Service consolidated recommendations from its bureaus and meetings with outside groups and developed proposals for further action against Asian influenza. These were submitted to the Secretary of Health, Education, and Welfare on the following day.

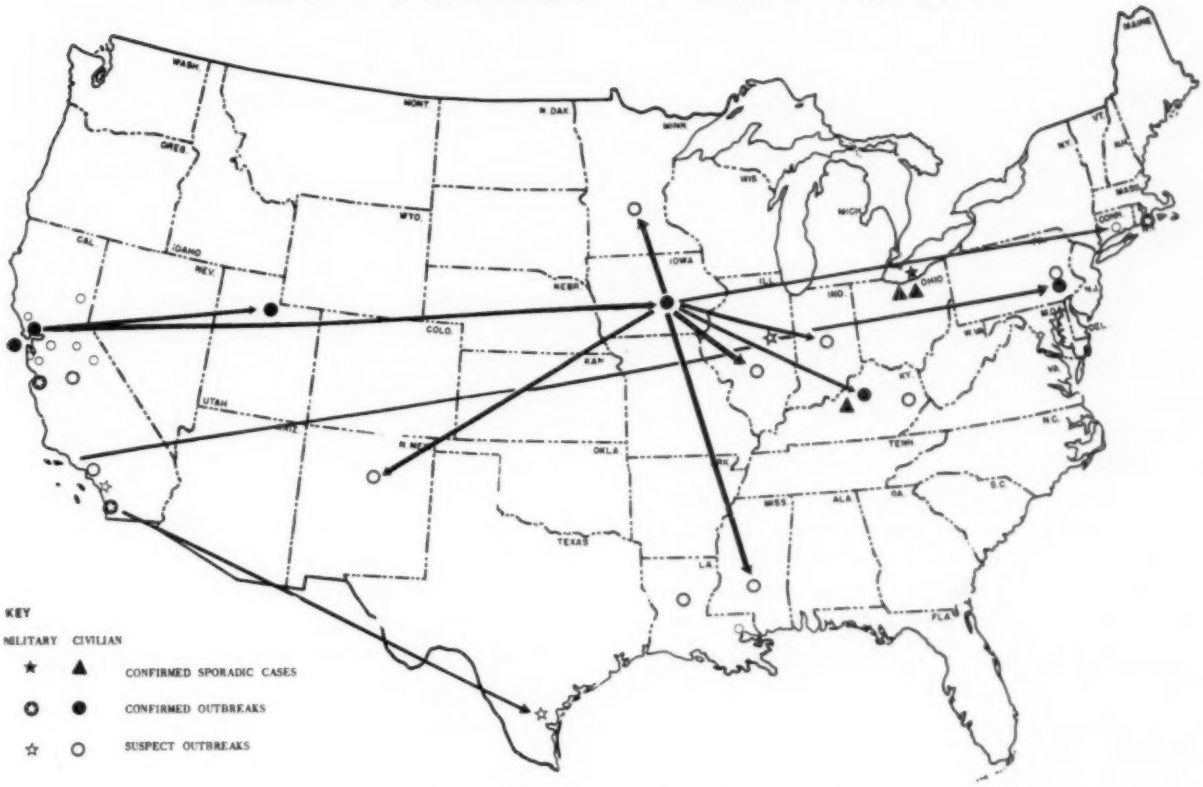
In Geneva on July 11, during the Fourth International Poliomyelitis Congress, the chief of the Endemoepidemic Diseases Section of the World Health Organization called an informal meeting of scientists present in Geneva to discuss the influenza situation. A useful exchange of information ensued. One of the incidental results of this meeting was international agreement that "Asian influenza" was both a descriptive and appropriate appellation for the contemporary manifestation of the ancient disease.

In mid-July two major policy decisions had to be made. Whether to recommend vaccination against influenza for civilians was one. Medically it was indicated, but the large quantities of vaccine that were needed had never been manufactured rapidly. The Surgeon General had decided to rely upon established physician-patient relationships for immunization. Except for protection of its own patients and employees, the Service did not plan purchases of vaccine. In these circumstances, could the manufacturers produce ample influenza vaccine? Would they shoulder the attendant risks?

From July 15 through July 19, the Surgeon General discussed the potential supply of influenza vaccine by telephone with each of the licensed manufacturers in turn. They appreciated the desirability, from the standpoint of public health, of immunizing as much as one-third of our population during the fall and winter. Given the forecasts of the epidemiologists and the plans being developed by the Public Health Service and the American Medical Association to meet an emergency, the manufacturers were willing to invest heavily in the production of influenza vaccine without financial assistance from the Government. Thus, a major administrative issue was resolved, and another significant contribution to the Nation's health was made by the industry.

The remaining unanswered question was whether to recommend that manufacturers continue making the monovalent vaccine then being produced solely to fulfill military contracts or to recommend production for civilian use of a polyvalent vaccine including the Asian strain. The opinion of the National Institutes of Health was that a polyvalent vaccine was preferable from an immunological standpoint, but the manufacturers were doubtful of their ability to produce large quantities of an effective polyvalent vaccine in the short time that remained. The National Institutes of Health conceded

Probable route of Asian influenza virus seeding, as of July 22, 1957.



that a monovalent vaccine would be preferable if the mortality associated with Asian influenza were to rise significantly. It seemed prudent as well as practical, therefore, to recommend a monovalent vaccine of the Asian strain for civilian use after the military needs had been met.

These were the crucial issues; the decisions were made by the Surgeon General. It was recognized also that these decisions should be "hedged" to reduce the adverse effects of rising influenza mortality, a possibility that could never be excluded. For this reason, the Division of Biologics Standards prepared a list of additional facilities that could produce influenza vaccine if the situation became more serious. It was believed that a mandatory allocation system for vaccine distribution and funds for purchase of vaccine and for public immunization clinics—all of which would also be necessary in the event of a grave emergency—could be obtained with relative speed if the situation ultimately warranted them.

On July 19 key officials of the Public Health Service discussed with the Under Secretary of Health, Education, and Welfare the plans of the Service, the American Medical Association, the State health officials, and the vaccine manufacturers to cooperate in an effort to control or minimize the expected epidemic and to utilize the opportunities for research that could be foreseen.

On July 23 the World Health Organization sent a circular letter describing the influenza situation and suggesting that "countries with good facilities for large-scale vaccine production should, after satisfying their priority requirements, make available at the lowest economic price any surplus vaccine for priority groups in countries less favorably situated."

On July 25 the Division of General Health Services was designated the "focal point" in the Bureau of State Services for information about BSS influenza activities. A memorandum from the National Institutes of Health of the same date reported that vaccine manufacturers were obtaining higher yields in terms of CCA units as they gained experience with the Asian strain, an optimistic report with respect to potential vaccine production. A larger out-

put or higher potency, or both, than heretofore anticipated now seemed ultimately feasible.

On July 26 the chairman of the Committee on Control of Infectious Disease, American Academy of Pediatrics, met with officials of the Office of the Surgeon General to discuss vaccination against influenza. The Service agreed to provide the committee with all relevant information as it became available; the committee in turn agreed to develop technical advice for the guidance of pediatricians with respect to vaccination.

On July 30 the Surgeon General wrote to all State and Territorial health officers summarizing developments in the influenza situation and advising them of a forthcoming public announcement of the Service campaign to encourage maximum use of influenza vaccine. On August 1 a representative group of State directors of health education met with the Assistant to the Surgeon General for Information and other officials in Washington, D. C., to learn in detail of the plans the Service was making to encourage use of the vaccine when it became available. The Public Health Service expected a major share of this campaign to be in the hands of the States, with materials and national efforts provided by the Service.

On August 2 the Service issued a statement to the press to launch its campaign of public information and health education, and the Surgeon General again met with the press en masse. It was then possible to state that the influenza vaccine manufacturers expected to produce about 8 million cubic centimeters by mid-September, half of which would be available for civilian use.

A meeting of representatives of the Armed Forces, Veterans Administration, and the Public Health Service on August 2 was devoted principally to the question of influenza vaccine dosage. The judgment of the Office of the Surgeon General, after reviewing studies reported by military, civilian, and Service investigators, was that inoculation of 1 cc. of monovalent Asian influenza vaccine with a strength of 200 CCA units was the most effective and practical dosage to recommend.

On August 6 the Surgeon General reviewed the situation in a conference with the Secretary of Health, Education, and Welfare. On the next day the Surgeon General and members of his immediate staff met with a committee representing the American Hospital Association to discuss the part hospitals could play in the care of the sick in the event of a serious epidemic.

Resources Readied for Epidemic

The Bureau of State Services reported on August 9 the first evidence of influenza occurring in epidemic proportions among the general population; previous outbreaks were among such "closed" groups as summer camps and naval vessels. On the same day the chief of the Civilian Health Requirements Unit completed an analysis of inventory increases by antibotics manufacturers in anticipation of greater needs for treatment of complications of influenza. It was estimated that from 25 to 40 percent more antibiotics than usual would be on hand during the fall and that inventories could be further increased to from 40 to 100 percent above normal requirements within 30 to 60 days. The Surgeon General recommended to the Office of the Secretary of Commerce on August 9 that the export of Asian influenza vaccine be controlled while it remained in short supply.

On August 12, by individual letters, the Surgeon General asked the vaccine manufacturers to cooperate with the Public Health Service in the maintenance of a voluntary system of equitable interstate allocations of vaccine so long as it remained in short supply. Plans for this system had been developed by the Bureau of State Services. All manufacturers agreed to cooperate.

On August 13 the Surgeon General called a special meeting of all State and Territorial health officers to consider plans for the prevention and control of influenza. This action was taken pursuant to authority contained under section 312 of the Public Health Service Act. Preparations for the meeting on August 27–28 were a major item of business during the rest of the month.

On the following day, the Public Health Service met with more than 50 representatives of official, voluntary, and professional groups in the fields of health, education, and welfare to plan cooperative efforts to deal with the anticipated epidemic. Much of the smooth function-

ing of the professional groups involved during the months ahead and the lack of alarm or hysteria on the part of the public may be attributed to the immediate and continuing response of the national organizations represented at this meeting.

On August 14, also, the Surgeon General appeared before the Committee on Appropriations of the Senate to testify with respect to the President's request for additional funds for influenza activities. The committee had before it the Supplemental Appropriation Bill, 1958, which had been passed by the House of Representatives. As finally enacted, this bill provided $800,000 in additional Public Health Service funds:

Production and distribution of diagnostic reagents	$225,000
Influenza surveillance and laboratory services	385,000
Data collection and dissemination	80,000
Public information and health education	110,000

In addition, transfer to influenza activities of $275,000 previously appropriated for communicable disease control was authorized. Standby authority was also granted to transfer as much as $2 million of emergency funds available to the President. Half was intended to defray the expense of calling several hundred Public Health Service reserve officers to active duty for loan to the States if the situation should worsen, and half was contemplated for purchase of medical supplies and equipment to be made available to States and communities in the event of a grave emergency.

On August 16 Public Health Service staff members met with representatives of the Army, the Committee on Disaster Studies of the National Academy of Sciences-National Research Council, the University of Pennsylvania (Project Big Ben), and the American Medical Association to discuss proposals for a study of the effects of an influenza epidemic on community organization and functioning. This study was later conducted, primarily by the Service.

On August 21 the Surgeon General forwarded to the President's adviser on personnel his recommendations with respect to influenza immunization for Federal employees, which had been developed after consulting the Civil Service Commission, the Federal Personnel Council, and others. On August 23 the Bureau of State Services reported influenza among school children in Louisiana and Mississippi communities where schools open during the summer before the fall harvest season begins. This development was correctly believed to foreshadow similar effects after schools opened in other communities during the fall.

With the special conference on influenza of the Surgeon General with the State and Territorial health officials on August 27–28, the Asian influenza program of the Service moved from its developmental phase into its operational period. The relevant information had been received and evaluated, the alternatives had been established, the major decisions had been made, the individuals and groups involved had been alerted, the necessary control activities had been started in the Service and elsewhere, and a campaign of public information and education had begun. A comprehensive account of the subsequent activities, however, must await a later diarist.

Income Tax Regulations on Medical Deductions

Internal Revenue Regulations which govern deductions for medical and dental expense have been published in the Federal Register, December 14, 1957 (22 FR 10054). They are sections 1.213 and 1.213–1 of title 26 of the Internal Revenue Code of 1954.

Medical care is defined, a special rule for decedents is spelled out, and examples illustrative of the regulations are included.

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Asian Influenza Surveillance

ALEXANDER D. LANGMUIR, M. D., MARIO PIZZI, M. D., WILLIAM Y. TROTTER., M. D., and FREDERICK L. DUNN, M.D.

IN MAY 1957 immediately after Dr. Maurice R. Hilleman, then with the Walter Reed Army Institute of Research, identified influenza viruses from the Hong Kong epidemic as "distinctly different from type A strains previously isolated from this country and Europe," steps were undertaken to meet the potential threat of an epidemic in the United States. It was anticipated that the new strain would be introduced into this country constantly by travelers returning from epidemic areas in the Far East. Single sporadic cases would probably be commonplace among such persons but difficult to recognize. Localized outbreaks among selected highly crowded population groups, particularly in the military forces, could also be expected, but no extensive epidemic spread was thought likely until fall.

All Epidemic Intelligence Service officers and all epidemiological personnel of the Communicable Disease Center, both at headquarters and in the field, were alerted for first priority duty in the investigation of influenza and influenza-like disease cases and outbreaks. During June few reports of cases were received, and these largely concerned personnel on military bases and ships. The first outbreaks appeared, surprisingly, among the crews of several destroyers at Newport Naval Station, R. I. In mid-June sharp outbreaks occurred among Navy recruits in San Diego and Army recruits at Fort Ord, Calif. At the end of June, an outbreak developed among high school girls at a conference on the campus of the University of California School of Veterinary Medicine at Davis, Calif. A nurse epidemiologist with the Communicable Disease Center participated with California State health officials in the investigation of this outbreak.

From June 28 to July 3 an outbreak of influenza appeared in Grinnell, Iowa, at a Westminster Fellowship Conference, which was attended by 1,680 delegates from more than 40 States and 10 foreign countries. A delegation of more than 100 students from California, at least one of whom had been exposed at the Davis conference, developed influenza en route and clearly introduced it to the other delegates. When this conference was disbanded, the infection was carried to all parts of the country. It was evident by this time, however, that the infection was being seeded in manifold ways.

In the early part of July, it became apparent that the routine morbidity reporting channels from the States to the National Office of Vital Statistics were not sufficient to handle the steadily increasing load of detailed reports. Accordingly, the Influenza Surveillance Unit was formally established in the Communicable Disease Center for the purpose of supplementing, but in no way replacing, the regularly established functions of the National Office of Vital Statistics. This surveillance unit was designed along lines similar to those initiated for the poliomyelitis surveillance reports in 1955. From its inception, the Influenza Surveillance Program was a joint undertaking of the Epidemiology Branch, with all of its Epidemic Intelligence Service officers and field personnel reporting continually and in detail, and the Respiratory Disease Unit of the Virus and Rick-

The authors are all with the Epidemiology Branch, Communicable Disease Center, Public Health Service, where Dr. Langmuir is branch chief and Dr. Pizzi, chief of the Surveillance Section. Drs. Trotter and Dunn are both in the Influenza Surveillance Unit.

ettsia Section of the Laboratory Branch, with its rapidly expanding system of collaborating influenza diagnostic and reference laboratories.

The information from these extensive sources was consolidated with the large amount of data reported directly to the National Office of Vital Statistics from the States and military services. Lengthy reports were prepared weekly and distributed to all State health officers, State laboratory directors, State epidemiologists, and many others having interests or responsibility in the study and control of influenza. The first of these reports was published July 9, 1957.

Nationwide Spread

During July, Asian strain influenza was disseminated widely through the country. Outbreaks occurred chiefly in closed population groups such as children's camps and military installations. California camps were most heavily affected.

From July 11 to 18 an International Boy Scout Jamboree held at Valley Forge, Pa., was attended by a total of 53,000 Scouts and leaders from every State and from several foreign countries. At the beginning of the encampment there was evidence of influenza among Scouts from Sacramento, San Francisco, and Los Angeles, Calif., and from Louisiana and Puerto Rico. En route to the Jamboree, when the Scouts were in close contact for extended periods of time, many became ill. Laboratory studies have since demonstrated that their disease was Asian influenza. During the encampment many additional cases occurred among contacts of the originally involved groups, but no large epidemic developed in the camp. Three Epidemic Intelligence Service officers were stationed at Valley Forge to gather basic epidemiological and laboratory data. Additional cases occurred among Scouts on the way home, although again most of these were in the California and Louisiana contingents.

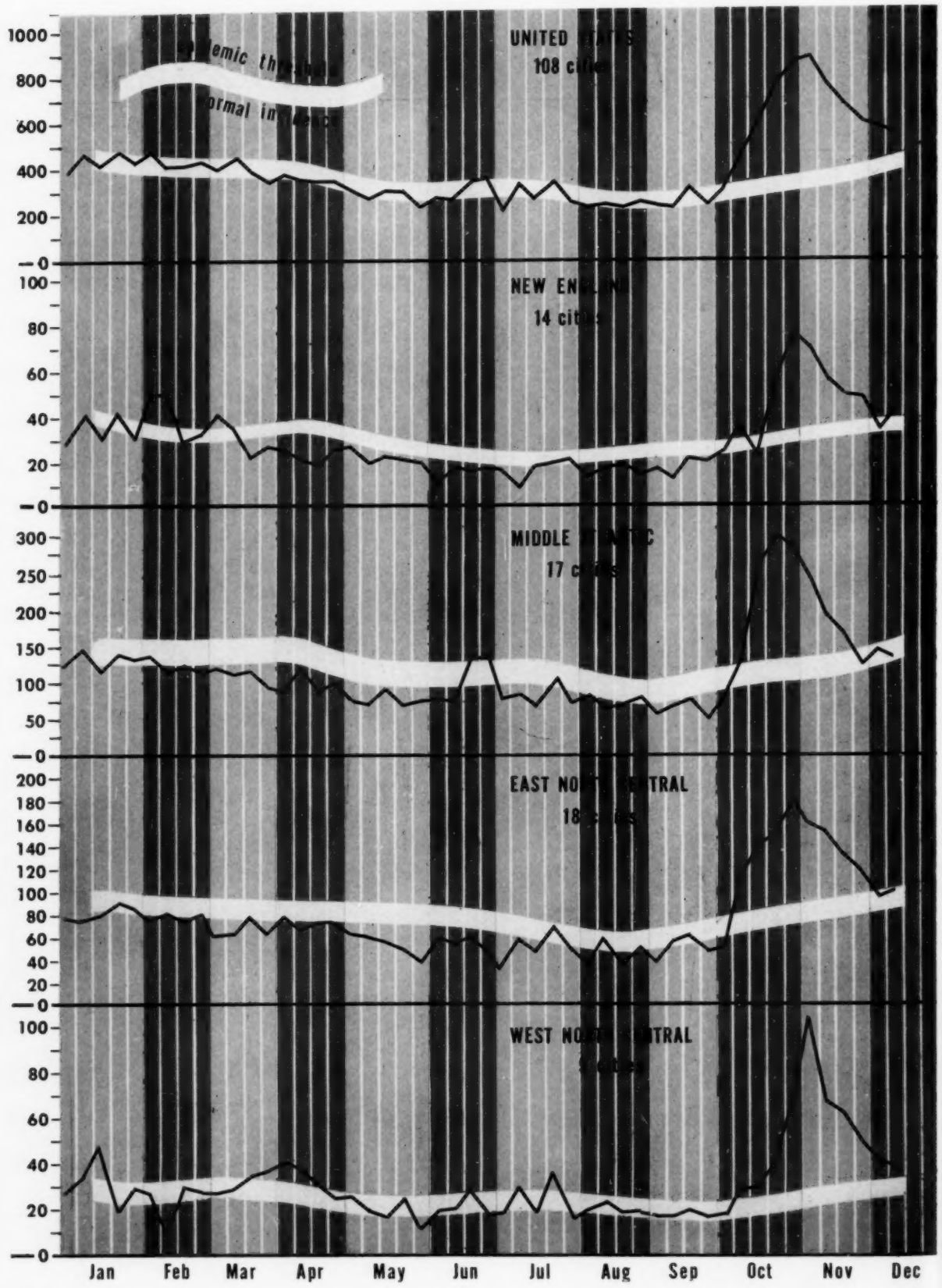
In the latter part of July, a number of new outbreaks occurred in children's camps throughout the country. Most of these could have been related either to the Boy Scout Jamboree or to other previously known outbreaks. There was very little evidence of community-wide outbreaks affecting children and adults during July.

Influenza continued to appear in sporadic fashion during August. Certain incidents increased its spread and gave warning of future developments. Migrant workers, exchange students, Scouts, and others continued to disseminate the disease. However, during early August a major communitywide outbreak occurred in Tangipahoa Parish, La. It was readily apparent that this outbreak was related to the opening of summer school sessions in this rural area where children were required to work at the harvest later in the season. Spread from school children to other members of families was clearly demonstrated. Shortly afterward, nearby New Orleans began to experience the first major urban outbreak. These outbreaks were investigated by Dr. J. D. Martin of the Louisiana State Department of Health and two members of the Epidemic Intelligence Service. The belief that a nationwide epidemic might well begin with the general opening of public schools was further supported when several Mississippi counties also experienced communitywide outbreaks originating in schools that reopened in mid-August.

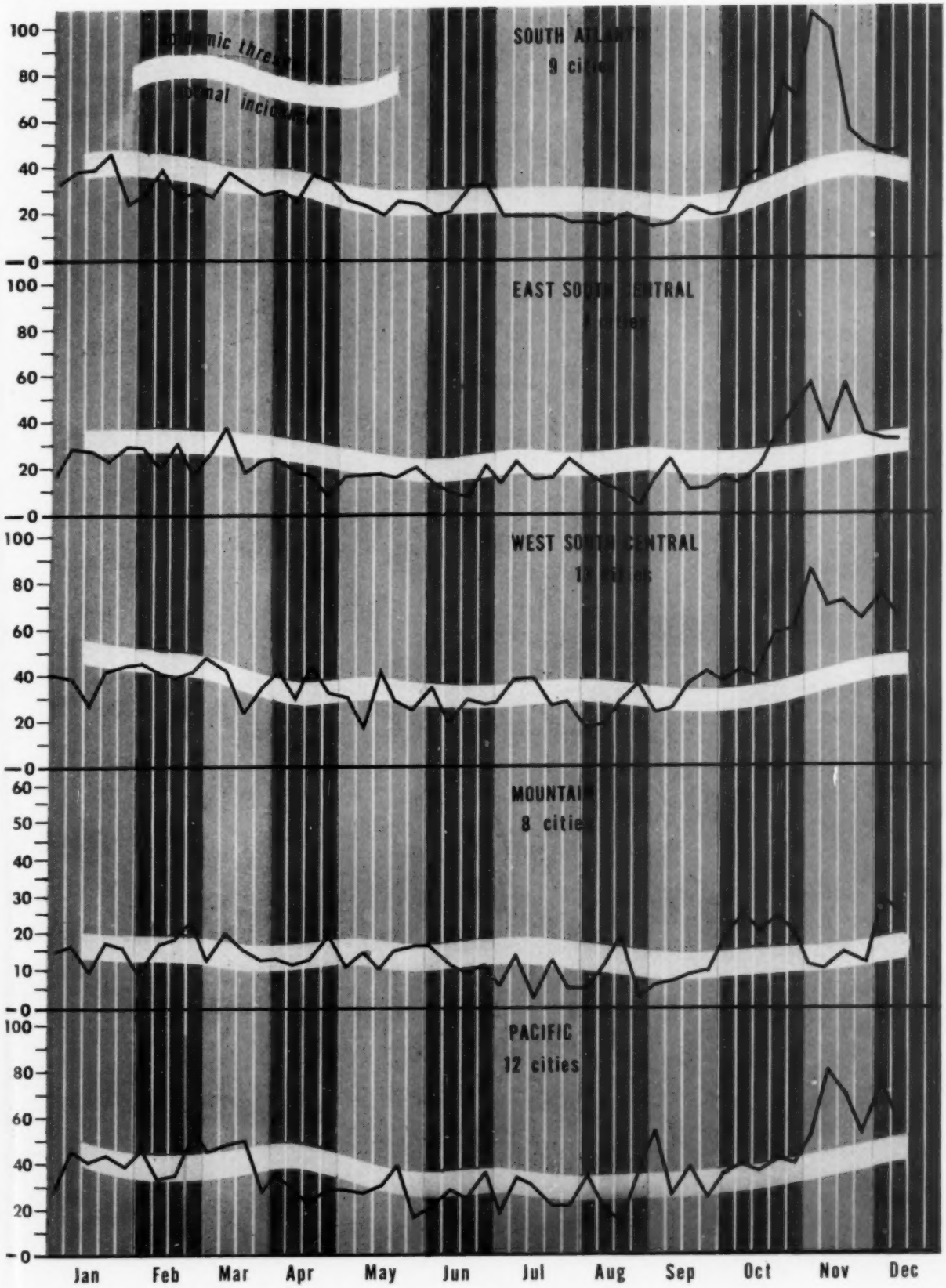
By late August there was no longer any doubt that a major nationwide influenza epidemic could be expected. For this reason, the Surgeon General of the Public Health Service called members of the Association of State and Territorial Health Officers to a special meeting on influenza to be held August 27 and 28. The purpose of this meeting was to review the influenza situation, to consider methods of control, and to coordinate all health activities to this end. One recommendation of the meeting resulted in a broadening and intensification of the CDC influenza surveillance activities. It was recommended that the States (*a*) adopt a program of epidemic reporting first by counties to the States and from them to the Public Health Service; (*b*) adopt a standard method of gathering and reporting information on outbreaks; and (*c*) sample absentee rates in selected schools and industries.

To facilitate this reporting by the States, the Communicable Disease Center designed a set of five forms. One of these was to be used for influenza reporting to the National Office

Figure 1. Weekly pneumonia and influenza deaths



in the United States through December 13, 1957.



of Vital Statistics and to the Center, and the others were to aid States in collecting data. On September 17 instructions and samples of each form were attached to the influenza surveillance report and sent to each State health officer, along with blanks for obtaining additional forms. Approximately 10,000 forms were mailed to the States to initiate their reporting systems, and an additional 45,000 have been sent to them since then in response to direct requests. Information gained from these forms has made it possible to estimate the geographic spread of the disease through the States.

In early September, as schools and colleges began to open, the number of influenza outbreaks increased greatly. Reports of new introductions of the disease by Mexican migrant laborers and foreign students continued. Communitywide epidemics spread further in the Mississippi-Louisiana region. Influenza vaccine was now being released in quantity, and weekly production and release figures were included in the surveillance report. In order to measure the effects of influenza precisely, weekly analyses were prepared of excess mortality from influenza and pneumonia in 108 major United States cities (fig. 1). Shortly after the first release of vaccine, reports began to appear of nonallergic vaccine-associated deaths. Prompt investigation of these reports showed them to be poorly substantiated, and this fact was noted in the surveillance reports.

During the month of September, many Epidemic Intelligence Service officers participated in studies of local epidemics in order to determine further the behavior of the disease. Epidemic Intelligence Service officers also participated with the CDC Laboratory Branch in studies of vaccine effectiveness at Atlanta Federal Penitentiary and conducted studies of vaccine reactions in various population groups.

Early in October excess influenza and pneumonia mortality began to rise in the West South Central division, and by the end of the month the Nation as a whole was clearly experiencing increased deaths. Voluntary reporting

Figure 2. Localized outbreaks and countywide epidemics of Asian influenza, through October 27, 1957.

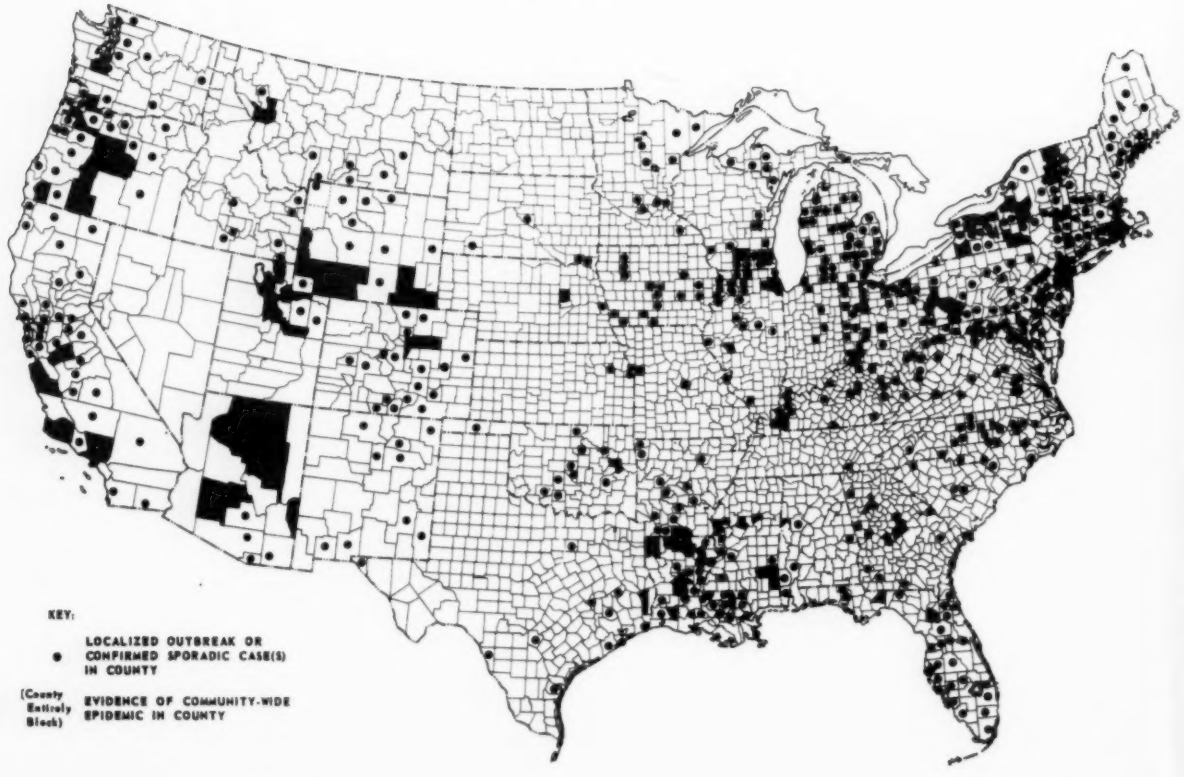
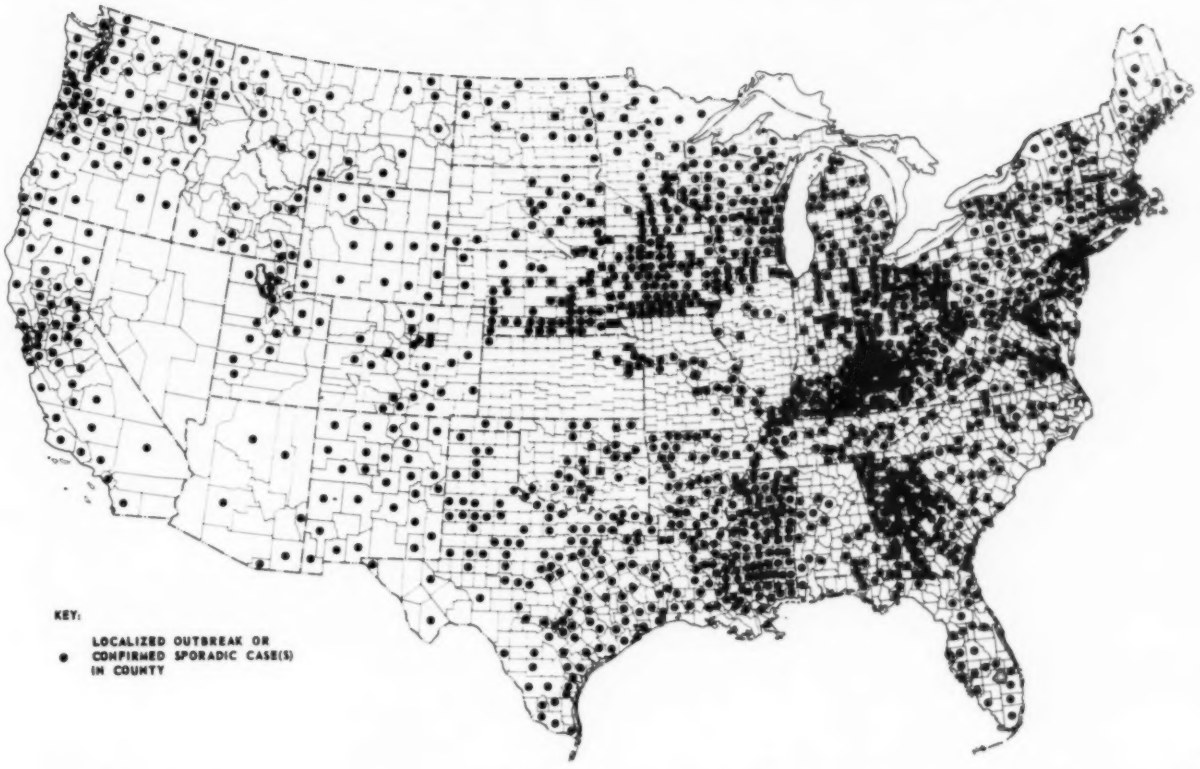

KEY:
LOCALIZED OUTBREAK OR CONFIRMED SPORADIC CASE(S) IN COUNTY
(County Entirely Black)
EVIDENCE OF COMMUNITY-WIDE EPIDEMIC IN COUNTY

Figure 3. Geographic spread of Asian influenza, by county, through December 2, 1957.



of detailed influenza case histories resulted in a collection of valuable information regarding deaths and complications. This information was interpreted and published in the influenza surveillance reports to aid in treatment and stimulate further investigations. On October 15, through cooperation with certain corporations, it was possible to present industrial absentee data for 36 major United States cities. Several cities showed significantly increased absenteeism early in October, and most cities were affected before November. By this time influenza had reached at least 20 percent of the counties, and the county map (fig. 2) was beginning to lose its significance as an indicator of incidence. At this time effort to distinguish localized outbreaks from countywide epidemics was discontinued, and a new map was made to show simple geographic spread by counties (fig. 3).

A further measure of the epidemic was provided by the U. S. National Health Survey as preliminary data which the Influenza Surveillance Unit was permitted to publish. From all the available methods of measurement, it was apparent that the epidemic was reaching a peak early in November, and by late November mortality, absenteeism, and new cases appeared to be on the decrease.

Despite the decline of the epidemic in late November 1957, the surveillance program continued in force because of the possibility of a second epidemic wave. The surveillance group continued its efforts to describe the epidemic and to define those areas in need of immediate or retrospective study.

Discussion

Although much data remain to be gathered, it is already possible to give a general picture of the 1957 epidemic as obtained through surveillance methods. Morbidity has been high, with clinical cases in approximately 25 percent of the population. But the mortality has been relatively low, in the range of 7,000 excess deaths from pneumonia and influenza. There has been no evident change in the severity of the cases with the progress of the epidemic, although it was possible to define certain special

risk groups such as pregnant women and persons with chronic cardiac and respiratory conditions. The present epidemic will probably result in more deaths than the A′ influenza epidemic of 1953 and may eventually prove to be more severe than the A epidemic of 1943. However, it is in no way comparable to the pandemic of 1918 and is less severe as measured by mortality than nine epidemics that have occurred since 1920. There has been a rather consistent pattern of initial involvement of high school children, followed by spread to elementary school children and adult populations. Industrial absenteeism increased a few days before excess mortality rose in a given urban community. Many deaths have occurred in the older age groups and in the debilitated. Staphylococcal pneumonia has been a prominent cause of death, although nonbacterial pneumonia has resulted in many deaths.

Sure Cures, 1918

"The present epidemic has given rise to the publication of numerous 'sure cures' and methods more or less plausible to the lay mind. The advocates of some of these have addressed long communications to Secretary McAdoo, to Surgeon General Blue, to the War Department, or other Government agencies. Hundreds of them have written to editors of newspapers. In general the suggestions fall into several groups.

"First comes the individual who has a specific remedy, the formula of which he is ready to give to the world for a price. One such writer reminds the Surgeon General of the million dollars that Congress has appropriated for combating influenza, and offers to sell his secret for 'a reasonable sum.'

"Next comes the person with the pseudoscientific treatment, sometimes 'isotonic sea water,' sometimes 'ozono therapy,' and again 'harmonic vibrations.' One such writer, well known to the New York health authorities, addressed the Surgeon General from his present residence, the State Hospital for the Insane.

"The list might be continued, but the suggestions are largely variations and repetitions of what has already been cited.

"The United States Public Health Service urges the public to remember that there is as yet no specific cure for influenza, and that many of the alleged 'cures' and remedies now being recommended by neighbors, nostrum vendors, and others do more harm than good. The chief reliance must be on fresh air, nutritious food, plenty of water, cheerful surroundings, and good nursing. If any specific like a vaccine or serum is found to have value the Public Health Service will give the matter wide publicity."

—*Public Health Reports, November 8, 1918.*

U. S. National Health Survey

Data on Acute Upper Respiratory Diseases

G. St.J. PERROTT and FORREST E. LINDER

IN AN unscheduled but propitious development, the U. S. National Health Survey is publishing current statistics which, in a tangential way, contribute notably to the aggregate of information on the influenza epidemic.

The data, the first to come from the new survey program, add several dimensions to the body of knowledge on communicable diseases. They come directly from a source we have not previously been able to tap on a national scale: the people affected by the diseases. They permit an association of incidence and prevalence with age and with two criteria of severity: bed disability and medical attendance. They provide a base for measuring the social and economic cost of the acute upper respiratory infections, including influenza.

The National Health Survey is not set up as an epidemic reporting system. Rather, it is designed to provide a continuing source of fundamental statistical information on the health of the American people in relation to important demographic, medical, social, and economic characteristics. This it will do in a series of reports which will begin to appear later in 1958. These reports will be based on data accumulated over one or more calendar quarters.

One part of the National Health Survey is a continuing household interview survey of a representative sample of the population, and it is this project that has provided current statistics on acute upper respiratory diseases. The household interview phase has been under way nationwide since July 1, 1957.

Mr. Perrott is chief of the Public Health Service's Division of Public Health Methods, in which is located the U. S. National Health Survey. He was director of the national health survey conducted in 1935–36, the last previous effort to collect comprehensive health data nationwide. Dr. Linder is director of the U. S. National Health Survey.

Background

Household interviewing is continuous in order to increase accuracy, improve efficiency, and permit accumulation, over various periods of time, of data necessary for study of different health problems. Partly because budgetary considerations do not permit a sample sufficiently large to yield current estimates for items of low incidence or prevalence, it was not contemplated that tabulations by week or month would be made. However, when it appeared that in the fall of 1957 influenza-like diseases would reach a higher than usual level of frequency, the survey staff decided to investigate the possibility that the household interview data would yield useful current information about these diseases. The investigation took the form of a special tabulation of the weekly receipts of household interview schedules which showed acute upper respiratory diseases severe enough to cause 1 or more days of bed disability. (Roughly, the diseases included are International Statistical Classification categories 470–493 and 500 and also a special category for "virus" not otherwise specified.)

The household interviewing is conducted for the Public Health Service by the Bureau of the Census, which designs and selects the sample and processes the data in accordance with specifications established by the Service. The interviewing is done by trained lay interviewers, and the sample interviewed each week is repre-

sentative of the civilian population of the continental United States. The weekly samples consist of approximately 700 households, or 2,200 persons. Since data are collected for the 2 prior weeks, each week's interviewing yields information on about 4,400 person-weeks of health experience.

The questionnaire asks for reports on illnesses of all types in the previous 2 weeks, the character of the illness, whether medical attention was received, whether there was bed disability, and, if so, the number of days of bed disability in the 2-week period. It also seeks information on a number of personal and demographic characteristics.

The data would permit identification of influenza, pneumonia, and other specific diseases as reported by the respondents, but the reliability of such diagnostic information from household reports is questionable. In any event, the interview respondent would not be able to differentiate Asian influenza from other respiratory diseases of similar symptoms and comparable severity. Even for medically attended cases a specific diagnosis is not always made. Accordingly, the special tabulation was applied to the broad group of acute upper respiratory diseases.

In September the National Health Survey began compiling and verifying the weekly data on this group of diseases. The first report appeared on November 2 in the form of a press release. It estimated, for the week ending October 5, the number of new cases involving bed disability (that is, requiring 1 day or more in bed) and the average number of persons in bed each day as a result of these diseases and gave the estimated total number of new cases and of person-days of bed disability from mid-July through October 5. Thereafter a provisional tabulation was issued each week carrying a chart of the new cases and the average number of persons in bed, together with supporting data and technical notes.

Later the cases under consideration were further classified according to whether they had been medically attended, according to age in four age groups, and according to length of time in bed. Calculations were made for various time periods between June 30 and the end of October, and the resulting data are presented in this paper for the first time.

New Cases and Days in Bed

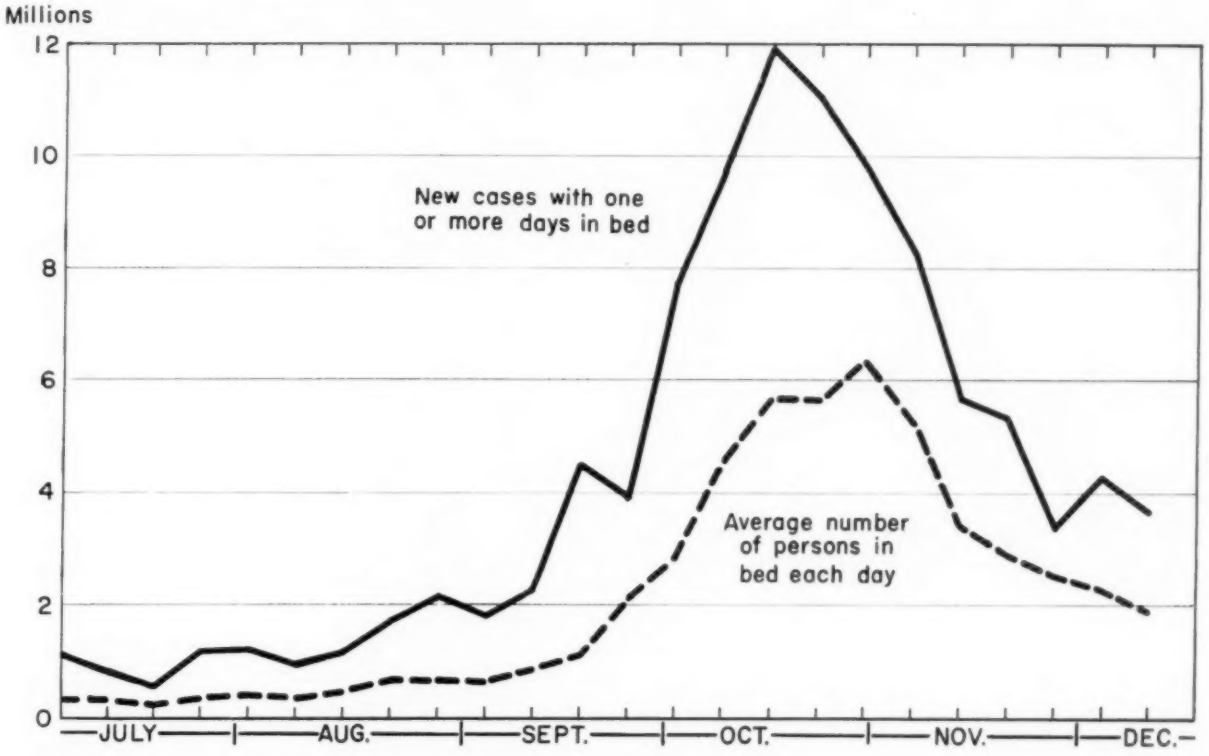
The two series of statistics that were obtained on a week-to-week schedule to trace the course of the epidemic were intended to show the incidence and the prevalence of cases of respiratory disease requiring 1 day or more in bed. Incidence is defined as the number of new cases starting in a specified interval of time, and prevalence, as the number of cases existing at any one time or the average number existing during some period. The incidence series is of greater interest from the epidemiological standpoint, while the prevalence data tend to reflect the social and economic impact of the epidemic by showing the average number of persons incapacitated during the week. A description of the manner of calculating these statistics will facilitate interpretation of the results.

New cases: Information collected in each household interview covers the previous 2 weeks but permits determination of the calendar week in which each case began. Therefore, from successive weekly samples two independent estimates are obtained for each calendar week. The figures presented are averages of the two estimates.

Average number of persons in bed: The prevalence series gives the average daily number of persons confined to bed during each week, and by multiplying each weekly entry by 7, the aggregate total number of days of bed disability can be computed. For this series it is possible to determine from the available data only the 2-week calendar period in which the bed-days occurred. However, a separate estimate is made each week so that estimates are available for successive 2-week periods, each overlapping 1 week with the previous period. By averaging the estimates for 2 successive 2-week periods, an estimate is obtained that relates to the overlapped calendar week. This figure is also the average daily number of bed-days of disability.

These two statistical series had quite different characteristics during the height of the recent epidemic, as may be seen in figure 1. The rise in number of new cases started from a low in mid-August and continued to a peak during the week of October 13–19, when about 12 million cases started (table 1). Almost as

Figure 1. Acute upper respiratory diseases [1] involving 1 or more days in bed: number of new cases and average number of persons in bed each day, by week, United States, July 1–December 14, 1957.



[1] Including also influenza, pneumonia, and other similar conditions.

rapidly as it had arisen this epidemic subsided. The statistics showing this drop at a season of the year when respiratory illnesses are usually climbing would have indicated that something out of the ordinary had happened, even if there had not been abundant evidence from other sources that a mild influenza was sweeping the country.

The average daily number of persons in bed started to rise later than the number of new cases, climbed less steeply, did not begin to fall until the new cases were already well past the peak, and then dropped off more slowly. At the highest point, the week of October 27–November 2, there was an average of 6,372,000 persons in bed each day.

It is of some interest that the estimated average number of persons in bed per day should have built up to a peak 2 weeks after the peak of new cases. The method of computing the prevalence index was partly responsible for this lag. As has already been mentioned, the prevalence estimate for each week is based on an average of two estimates each of which relates to a 2-week period, one period overlapping the other by 1 week. Statistically this is equivalent to a 3-week moving average with a weight of 2 given to the center week and a weight of 1 each to the week preceding and the week following this center week.

Apart from this, a lag would be expected in the prevalence figure since in any one week it is affected by a piling up of unrecovered cases that started in previous weeks. Since the usual duration of these cases appears to have been rather short, the lag resulting from this piling up might have been expected to be no more than a week. Evidence which will be presented in the next section, however, suggests that there was a tendency for the dura-

Table 1. Acute upper respiratory diseases [1] involving 1 or more days in bed: number of new cases and average number of persons in bed each day, by week, United States, July 1–December 14, 1957

Week	New cases involving 1 or more days in bed *(thousands)*	Average number of persons in bed each day *(thousands)*
June 30–July 6	1, 105	319
July 7–13	846	311
July 14–20	578	253
July 21–27	1, 203	342
July 28–Aug. 3	1, 264	425
Aug. 4–10	955	339
Aug. 11–17	1, 181	447
Aug. 18–24	1, 758	675
Aug. 25–31	2, 159	654
Sept. 1–7	1, 819	651
Sept. 8–14	2, 279	856
Sept. 15–21	4, 487	1, 152
Sept. 22–28	3, 952	2, 094
Sept. 29–Oct. 5	7, 773	2, 845
Oct. 6–12	9, 712	4, 551
Oct. 13–19	11, 933	5, 699
Oct. 20–26	11, 033	5, 665
Oct. 27–Nov. 2	9, 808	6, 372
Nov. 3–9	8, 297	5, 262
Nov. 10–16	5, 648	3, 389
Nov. 17–23	5, 305	2, 867
Nov. 24–30	3, 339	2, 518
Dec. 1–7	4. 271	2, 276
Dec. 8–14	3, 667	1, 886

[1] Including also influenza, pneumonia, and other similar conditions.

tion of stay in bed to increase slightly as the epidemic progressed.

A rather startling aspect of these national figures on acute upper respiratory disease cases is the size of the numbers. Two things must be borne in mind in this connection. First, the statistics relate to the entire civilian population of the country, approximately 168 million in number; and, second, the estimates relate to some of the commonest ailments that mankind is heir to, as well as Asian influenza. In any winter, colds, sore throats, acute bronchitis, and similar conditions will probably affect a very sizable portion of the population, many of them more than once. Since these data from the National Health Survey are available for the first time this winter, there is no way of measuring the extent to which the number of respiratory cases was higher than usual. Nevertheless, it is an impressive fact that on approximately 104 million occasions between June 30 and December 14 people took to their beds for a day or more because of illnesses of this type.

What fraction of these cases were influenza of the Asian strain? The National Health Survey household interviews yield no reliable data on this point. However, they provide the basis for interesting speculation on related matters. For example, if there is evidence from other sources that x percent of the upper respiratory disease cases during this period were Asian influenza, the survey results would suggest that by December 14 approximately $0.62x$ percent of the entire civilian population of the country had acquired some natural immunity to the Asian strain.

During this same 24-week period acute upper respiratory diseases accounted for about 363 million days of illness in bed. This total is equivalent to 994,000 person-years lost from usual activities, such as work, housekeeping, or school, and it does not include days of reduced activity when the person was incapacitated but did not go to bed. Using such data it would be possible on the basis of various plausible assumptions to make estimates of the monetary loss to the economy as a result of the upper respiratory diseases in an epidemic winter.

Length of Stay in Bed

The data on length of stay in bed tallied from the National Health Survey questionnaires provided a measure of the severity of cases of acute upper respiratory diseases. This information has to be treated with caution, however, since the bed stay for some of the cases had not terminated at the beginning of the interviewing week. In order to deal only with cases likely to be complete, analysis of length of stay in bed is restricted to cases that began during the second week before the week of interview. Since these cases began at least 7 days before the end of the 2-week period, cases requiring less than 7 days in bed were complete. The most that can be said about the length of time in bed for the other cases is that it was 7 days or more. Table 2 shows the frequency distribution of length of stay in bed for cases starting during 4 periods cor-

responding roughly to the 4 calendar months of July, August, September, and October.

Although the number of cases in the sample during July and August was quite small and the errors of sampling are therefore relatively high, the frequency distributions in table 2 point to an increase in the length of bed-stays during October as compared with earlier months. For example, the percentages of cases resulting in 3 or more days in bed were about 46 in July, 42 in August, 44 in September, and 56 in October.

For the whole of the 17-week period from June 30 to October 26 only about 1 case in 8 kept the person in bed for a week or more. This seems to confirm evidence from many other sources that the great majority of the cases during this period were mild.

Age Variations

Acute upper respiratory diseases causing 1 or more days of bed disability occurred more frequently among children and adolescents than among adults during the entire 4-month period. As shown in figure 2, the weekly rate of occurrence of new cases per 1,000 population was highest for the age group 5–19 years, somewhat lower for the age group 0–4 years, and lowest for the two age groups over 20 years old.

Although the average rate of occurrence of acute respiratory diseases for the 4-month period varied with age, little difference is found among the rates for the different age groups during July and August. The rates of occurrence for the four age groups are all quite low and similar in size (table 3). Although these rates may appear to vary inversely with age, care should be taken in inferring from these data any differences between the age groups for the July-August period, since these low rates are subject to relatively large sampling errors.

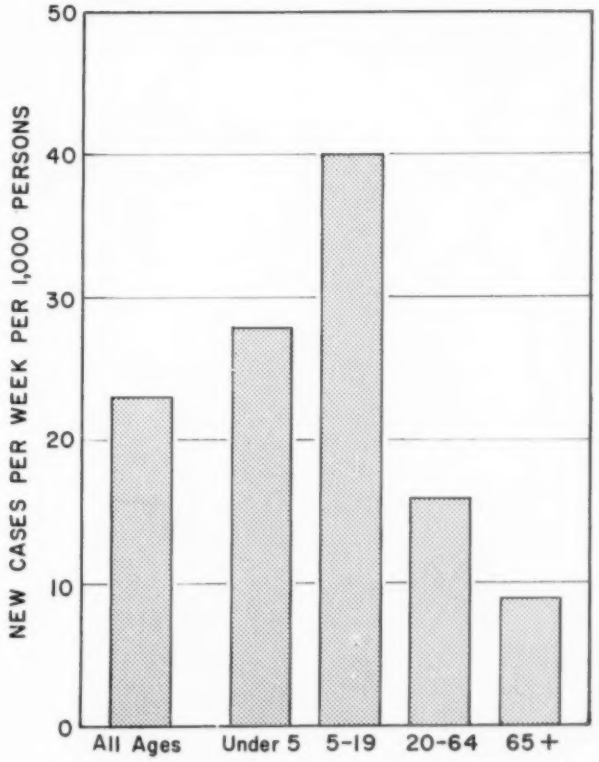
During October the age differences were marked. The average weekly rate of occurrence of new cases was highest for the age group 5–19 years, which had a weekly rate of 111 cases per 1,000 persons. The 0–4 year age group was next, with a weekly rate of 62 cases per 1,000 persons, while the two older age groups had the lowest rates, 41 for the age group 20–64 years and 21 for the age group 65 years and above. It should be noted that the age group

Table 2. Acute upper respiratory diseases [1] involving 1 or more days in bed: percentage distribution of new cases by length of time in bed, United States, June 30–October 26, 1957

Number of days in bed	Period of onset				
	June 30–Oct. 26	June 30–Aug. 3	Aug. 4–Aug. 31	Sept. 1–Sept. 28	Sept. 29–Oct. 26
All cases	100	100	100	100	100
1–2	48	54	59	55	44
3–6	38	36	30	32	42
7 or more	13	10	12	12	14

[1] Including also influenza, pneumonia, and other similar conditions.

Figure 2. Acute upper respiratory diseases [1] involving 1 or more days in bed: average number of new cases per week per 1,000 persons, by age group, United States, June 30–October 26, 1957.



[1] Including also influenza, pneumonia, and other similar conditions.

Table 3. Acute upper respiratory diseases [1] involving 1 or more days in bed: average number of new cases per week and average number of new cases per week per 1,000 persons, by time period and age group, United States, June 30–October 26, 1957

Time period and age group	Average number of new cases per week (*thousands*)	Average number of new cases per week per 1,000 persons in age group
June 30–Oct. 26		
All ages	3,927	23
0–4	534	28
5–19	1,797	40
20–64	1,460	16
65 and over	136	9
June 30–Aug. 31		
All ages	1,243	7
0–4	279	15
5–19	406	9
20–64	517	6
65 and over	40	3
Sept. 1–28		
All ages	3,181	19
0–4	385	20
5–19	1,490	33
20–64	1,154	13
65 and over	152	10
Sept. 29–Oct. 26		
All ages	10,135	60
0–4	1,198	62
5–19	4,936	111
20–64	3,684	41
65 and over	317	21

[1] Including also influenza, pneumonia, and other similar conditions.

5–19 years not only had the highest rate of occurrence but also accounted for a substantial proportion of the total number of cases. Although this age group represents only 25 percent of the total population of the country, it accounted for almost 50 percent of the total new cases that occurred during October.

The relationship between age and days spent in bed due to acute respiratory diseases presents a pattern similar to that shown by the relationship between rate of occurrence and age. During the 4-month period the average number of persons in bed each day per 1,000 population was higher for children and adolescents than for adults (table 4). The age group 5–19 years had the highest rate, 17 persons in bed per day per 1,000 persons. The age group 0–4 years had a rate of 10 per 1,000 persons, while the age groups 20–64 and 65 and above had lower rates of 7 and 5, respectively.

During July and August the average numbers of persons in bed per day per 1,000 persons

Table 4. Acute upper respiratory diseases [1] involving 1 or more days in bed: average number of persons in bed each day and average number of persons in bed each day per 1,000 persons, by time period and age group, United States, June 30–October 26, 1957

Time period and age group	Average number of persons in bed each day (*thousands*)	Average number of persons in bed each day per 1,000 persons in age group
June 30–Oct. 26		
All ages	1,714	10
0–4	201	10
5–19	778	17
20–64	655	7
65 and over	80	5
June 30–Aug. 31		
All ages	467	3
0–4	93	5
5–19	148	3
20–64	201	2
65 and over	25	2
Sept. 1–28		
All ages	1,281	8
0–4	145	8
5–19	565	13
20–64	478	5
65 and over	92	6
Sept. 29–Oct. 26		
All ages	4,681	28
0–4	474	25
5–19	2,271	51
20–64	1,756	19
65 and over	181	12

[1] Including also influenza, pneumonia, and other similar conditions.

Table 5. Acute upper respiratory diseases [1] involving 1 or more days in bed: number and percentage of cases which were medically attended among all new cases, by date of occurrence, United States, June 30–October 26, 1957

Time of occurrence	New cases *(thousands)*	Medically attended *(thousands)*	Percent medically attended
June 30–Oct. 26	64, 037	32, 991	52
June 30–July 20	2, 529	1, 629	64
July 21–Aug. 3	2, 467	1, 696	69
Aug. 4–17	2, 136	1, 305	61
Aug. 18–31	3, 917	2, 260	58
Sept. 1–14	4, 098	1, 889	46
Sept. 15–28	8, 439	3, 477	41
Sept. 29–Oct. 12	17, 485	8, 323	48
Oct. 13–26	22, 966	12, 412	54

[1] Including also influenza, pneumonia, and other similar conditions.

were similar and relatively low for each of the age groups. During October, however, substantial differences between the age groups occurred. For the age group 5–19 years, the average number of persons in bed each day was 51 per 1,000 persons, more than twice the figure for any of the other age groups. Almost one-half of the total number of bed-days of disability that occurred during October were experienced by persons in this age group, although, as was mentioned previously, the age group constitutes only one-quarter of the country's population.

Medical Attendance

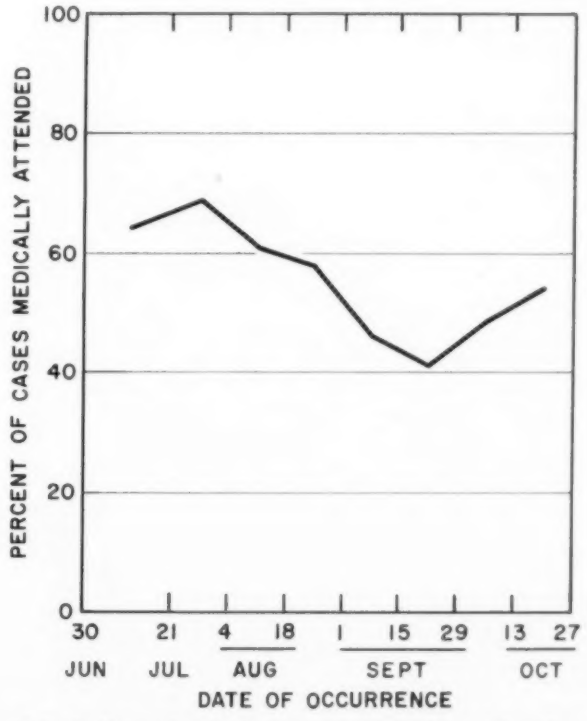
In the household interviewing project of the National Health Survey, medically attended cases are those for which a doctor was consulted at home, at work, at the physician's office, in a clinic, or over the telephone.

Table 5 and figure 3 show, by date of occurrence, the proportion of cases that were medically attended among all new cases of upper respiratory conditions causing bed disability. During early and middle summer, when the frequency of these conditions was low, the proportion medically attended was around 60 to 70 percent. The proportion decreased to about 40 percent in late September and then turned upward to about 50 percent in October, when the reported frequency of bed cases of acute respiratory conditions was at a peak.

For the entire period the proportion of medically attended cases was higher for the very young and for persons over age 65 years than for persons in the school or working ages. The proportion of cases medically attended decreased in September and increased in October within each age group as well as in the total population (table 6).

During the period of this report there were undoubtedly changes in the proportions of the various types of conditions reported under the broad category of acute upper respiratory conditions. This, together with changes in the volume of acute conditions, is probably reflected in the observed pattern of medical attendance. There are no comparable data for previous years, and the reason for the pattern of medical attendance seen here is a matter of conjecture.

Figure 3. Acute upper respiratory diseases [1] involving 1 or more days in bed: percentage of cases which were medically attended among all new cases, by date of occurrence, United States, June 30–October 26, 1957.



[1] Including also influenza, pneumonia, and other similar conditions.

Table 6. Acute upper respiratory diseases [1] involving 1 or more days in bed: percentage of cases which were medically attended among all new cases, by month of occurrence and age, United States, July–October 1957

Month	Age group				
	All ages	0–4	5–19	20–64	65 and over [2]
July–October	52	59	51	48	58
July and August	62	71	69	53	57
September	43	52	43	39	45
October	51	55	51	49	65

[1] Including also influenza, pneumonia, and other similar conditions.

[2] Figures for persons 65 and over are based on small numbers of cases in any given month and should be interpreted with caution.

It is possible that part of the increased volume of new cases in September is due to a normal seasonal increase in minor respiratory conditions for which medical attention is seldom sought. The October increase in the percentage of cases attended by a physician may result from the relatively heavier impact of influenza and an accompanying increase in severity, indicated by the longer stay in bed.

It is noteworthy that the lower proportion of cases which were medically attended in the latter half of the reporting period does not imply a decreased total volume of medical care. In the last 2 weeks of October there were about 12.4 million medically attended cases (table 5). This is greater than the number of medically attended cases during the entire 9 weeks of July and August.

The 12.4 million cases with medical consultation in the last half of October are cases for which the person went to bed. Estimates from other current National Health Survey data on acute respiratory diseases show that there were about half again as many cases with medical consultation but no bed disability. It can therefore be estimated that in this concentrated period of time approximately 18 million cases of acute upper respiratory conditions had medical attention, representing a tremendous volume of consultation and treatment provided by the medical profession.

Reliability of Data

Approximate sampling errors have been calculated for the estimated number of new cases each week. The sampling error varies somewhat from week to week, but 15 percent has been a typical relative error. This means that the estimated number of new cases for 2 weeks out of 3 should be within 15 percent of the figure that would be obtained from a complete enumeration, and it would be expected to be within 30 percent of a complete count in 19 out of 20 weeks.

Relative sampling errors for average number of persons in bed each day for any given week are of the same order of magnitude as for new cases. Estimates in adjacent weeks of average number of persons in bed are not entirely independent of one another, however, whereas each weekly estimate of new cases is independent of estimates for other weeks.

The sampling error for estimated proportion of persons with 3 or more days of bed disability also varies from week to week, but it is near 10 percent.

For monthly estimates, sampling errors are about 50 percent of those for the corresponding weekly figures. For estimates which refer to the entire 4-month period, sampling errors are about 25 percent of those for corresponding weekly data.

In considering reliability of items for which sampling errors have not been presented, two suggestions are offered. First, samples in any given week are quite small; consequently, a figure for any week or for the change from one particular week to another is subject to substantial sampling error and to fairly high risk of error from nonsampling sources. Second, it is desirable to focus attention on the general level or trend indicated by the collective evidence of several adjacent weeks, rather than on the level in any single week or the change from one week to the next. Similarly, samples for some subclasses shown are small, and there is advantage in considering the pattern reflected through several related subclasses.

The estimates of sampling error presented here do not allow for errors of response and nonreporting.

Influenza Vaccine

JOSEPH E. SMADEL, M.D.

ANOTHER significant episode in the mass immunization of a large civilian population occurred during the Asian influenza epidemic. The acceptance of the current influenza vaccine program by laymen, physicians, and public health officials undoubtedly was favorably influenced by the highly successful campaigns for immunization against poliomyelitis. On the other hand, the development of Asian influenza vaccine and the production of almost 50 million ml. of this vaccine during the 7 months after the newly isolated viral agent was first brought to this country represent a remarkable feat which could have been accomplished only because of the enormous experience gained through the extensive study of influenza during the past two decades.

Dr. Thomas Francis and his associates of the Commission on Influenza of the Armed Forces Epidemiological Board have been outstanding leaders in the extended studies of influenza and in the development and demonstration of the efficacy of influenza vaccines (*1*). Following the pattern developed by the commission, the Army Medical Department and the Public Health Service created a series of influenza watch laboratories to assist in providing prompt and accurate information on the occurrence and spread of influenza. These watch laboratories have since been integrated with the World Health Organization's system which now encircles the globe (*2*).

Dr. Smadel is an associate director, National Institutes of Health, Bethesda, Md. *This paper is based on comments at a symposium on Asian influenza held by the American College of Preventive Medicine and the health officers' section at the 1957 meeting of the American Public Health Association in Cleveland, Ohio.*

A little-known experiment undertaken by American influenza investigators and the vaccine producers several years ago provided additional background for the work in 1957 with Asian influenza vaccine. In 1951 England experienced a moderately severe outbreak of influenza, which was considered a possible hazard to the United States. It was decided to determine how quickly the British virus could be imported and analyzed for antigenic composition, and incorporated into a vaccine, if it were found to be different from the earlier strains of influenza virus. Accordingly, at the height of the epidemic in Liverpool, British colleagues supplied a strain which was flown to the United States and promptly distributed to the laboratories at Walter Reed Army Institute of Research and the National Institute of Allergy and Infectious Diseases, Public Health Service. The institute, in turn, sent samples to the influenza vaccine manufacturers. The self-imposed problem of the various laboratories was to produce 1 liter of vaccine of acceptable potency, sterility, and safety in the shortest possible time. The two Government laboratories accomplished their task before the end of 3 weeks and the biologic houses shortly thereafter. The various workers recognized the portent of their achievement but realized that many factors had been in their favor and that similar success might not be regularly attained.

Development of Asian Influenza Vaccine

The present influenza vaccine program must make obeisance to each of the earlier developments described above. Using the watch laboratory organization, the Army Medical Department isolated the Asian influenza virus from patients in the Far East in late April.

By mid-May the Department recognized that the virus was antigenically dissimilar from other influenza A viruses and that the American population was virtually without protective antibodies against the new strain (*3*). Simultaneously, investigators in other countries made comparable observations. Numerous other investigators in university, governmental, and industrial laboratories in the United States began their studies on the Asian virus during the last week of May. In the meantime, WHO influenza detection centers throughout Asia, the Western Pacific, Australia, and the Middle East noted and reported the rapid spread of influenza from Hong Kong. It soon became apparent that the new virus was highly contagious, provoking large epidemics affecting up to 20 percent of the general population in one area after another, and in certain selected groups involving 60–70 percent of the population. Fortunately, the mortality remained low as the disease continued its sweep (*4*).

As a result of intensive work in the commercial laboratories, the first experimental lots of Asian monovalent vaccine were available before mid-June and were promptly placed under assay in volunteers by personnel of the Commission on Influenza, the Army, and the Public Health Service. It is worth noting that the first cases of Asian influenza were diagnosed in the continental United States during the first week of June (*5a*).

The military services, during the latter part of June, provided a most important stimulus to the commercial production of vaccine by inviting bids for 2,650,000 ml. of monovalent Asian vaccine. At about the same time, the Surgeon General of the Public Health Service informed the manufacturers that he anticipated the need for large amounts of influenza vaccine for use by the civilian population during the coming fall and winter. With these demonstrations of active interest in a vaccine prepared against the newly isolated Asian influenza virus, the manufacturers that had produced influenza vaccine in previous years offered to make a strenuous effort to meet the demands created by the anticipated epidemic. These manufacturers undertook this commitment, which involved considerable financial risk, without government subsidy.

Vaccine Dosages

The Public Health Service recommends tne following dosages of Asian influenza vaccine:

For those who have not been vaccinated, subcutaneous injection of 1.0 cc. of the 400 CCA unit strength Asian influenza vaccine currently being produced.

For those who have received 0.1 cc. intracutaneously or 1.0 cc. subcutaneously of the 200 CCA unit vaccine previously produced and for those individuals at special risk (pregnant women, older persons, and those with chronic respiratory or cardiac disease), a second 1.0 cc. subcutaneous injection of 200 CCA vaccine is recommended. Physicians may also wish to recommend a second injection for other patients. If the 400 CCA unit strength vaccine is available, 0.5 cc. should be given. The second dose should be received not less than 2 weeks after the first.

For children, the recommendation of the American Academy of Pediatrics is: For children under 5 years of age, 0.1 cc. intracutaneously or subcutaneously, repeated after 1 to 2 weeks; for children from 5 to 12 years of age, 0.5 cc. subcutaneously, repeated after an interval of 1 to 2 weeks; for children over age 13, the adult dosage.

The summer months were devoted to solving technical problems such as (*a*) increasing the yield of virus growing in embryonated eggs, (*b*) developing methods for assaying potency which would circumvent the time-consuming procedures previously employed, (*c*) determining the immunogenicity of the vaccine in man, (*d*) training new technical teams in the pharmaceutical houses and renovating old facilities or constructing new, and (*e*) arranging for unprecedented quantities of fertile hens' eggs.

By mid-August, two manufacturers had produced a total of 500,000 ml. of monovalent Asian vaccine and obtained its release by the Division of Biologics Standards of the Public Health Service. Progress thereafter was rapid. Before the end of the first week in September, each of the six companies manufacturing the vaccine had produced one or more lots

meeting the requirements. Moreover, 4,600,000 ml. of vaccine (total bulk volume) was released by the Division of Biologics Standards by September 5. Production increased dramatically, and by the end of October 42,600,000 ml. bulk vaccine had passed the tests performed concurrently by the vaccine manufacturers and by the Division of Biologics Standards.

Potency and Efficacy of Vaccine

Drawing on the fund of knowledge accumulated over the years from field trials by the Commission on Influenza, it was estimated in June that the effective dose of Asian strain vaccine would probably be not less than 200 chicken cell agglutination (CCA) units when administered subcutaneously to adult human beings. Because of the difficulties encountered during the early summer in obtaining high yields of Asian virus in embryonated eggs, it seemed unlikely that a vaccine containing more than 200 CCA units of Asian antigen could be produced. Hence, the potency of the new monovalent vaccine was set at 200 CCA units per milliliter (*6a*).

A series of studies undertaken during the summer by members of the commission, the Army Medical Department, the Communicable Disease Center, and the National Institute of Allergy and Infectious Diseases was designed to determine the effective dose of Asian antigen. Only those experiments bearing on three specific points will be mentioned. One is concerned with the level of antibody which developed in patients convalescent from Asian influenza. Another deals with the amount of viral antigen required to elicit a similar level of antibody in a vaccinated person. A third point is concerned with the level of antibody found in volunteers who were resistant to experimental challenge with Asian virus.

If some license is permitted in interpreting data of others, it may be stated that levels of hemagglutination inhibition antibodies of the order of a titer of 1:32 actual dilution of serum (or 1:128 final dilution of serum) were present in convalescent serums (*3*). Moreover, to induce a similar level in about 90 percent of persons inoculated with a single dose of vaccine given subcutaneously, 400–500 CCA units of antigen were required (*7*), according to Keith E. Jensen of the Communicable Disease Center. Finally, appreciable resistance to challenge was displayed by those volunteers who had antibody levels of the order of 1:32. (In the tests of Bell and associates (*7*), 78 percent of the placebo controls developed signs of illness following challenge; 60 percent of vaccinated persons who failed to acquire detectable antibodies became ill; 43 percent of those with titers of 1:10 to 1:20 developed influenza; while only 25 percent of those who had titers of 1:40 or greater became ill.)

Such information as this, coupled with knowledge of the improved yields of virus from infected eggs and the increased facilities of the manufacturers, led to a recommendation in October that the potency of monovalent Asian influenza vaccine "be increased from 200 CCA units to 400 CCA units per milliliter as soon as feasible and not later than December 1, 1957" (*6b*). Current recommendations for the use of the vaccine appear on p. 130.

October 1957 saw the shift to the production of 400 CCA unit vaccine. Indeed, by November 1, two manufacturers had submitted to the Division of Biologics Standards for concurrent testing 13 lots with the 400 CCA unitage. As of November 12, 2 million ml. of 400 unit vaccine had been released by the division; 13 million ml. was available by December 12.

The report of Dr. Fred Davenport which appears in this issue (pp. 133–139) presents the available field information dealing with efficacy of Asian vaccine among military populations. In general, the data provide grounds for encouragement.

For many years, the influenza vaccines used in civilian and military populations have been of the polyvalent type, containing several strains of influenza A virus and one or more strains of influenza B virus. The formula for a polyvalent material which is now being produced for use during the latter part of the winter is as follows: influenza A, Asian strain—200 CCA; influenza A′, PR 301 strain—100 CCA; influenza A, PR 8 strain—100 CCA; and influenza B, Great Lakes strain—100 CCA. The recommended basic course of immunization consists of 2 subcutaneous injections each

of 1.0 ml., the second following the first by not less than 2 weeks.

Future

While the record to date for developing and producing Asian vaccine has been truly amazing, it would be foolhardy to assume that it will be possible to do as well or better the next time the country is confronted with a severe epidemic caused by an unfamiliar strain of influenza virus. There was an interval of almost 6 months between the time the first strain of Asian virus reached a research laboratory in the United States and the time at which the weekly pneumonia and influenza deaths increased above the "epidemic threshold" in the 108 cities which are under surveillance by the Communicable Disease Center (*5b*).

Suppose the next widespread occurrence of influenza begins in North America or arrives here promptly and reaches epidemic proportions within a month or so? The measures which were successful in this epidemic did not provide any useful quantity of vaccine during the first 2 months after the virus seed reached the manufacturers. I think it is obvious that the search must continue for means of rapidly increasing the resistance of populations to epidemic influenza.

Recognition of this fact was one of the reasons the Surgeon General of the Public Health Service, on the recommendation of the Association of State and Territorial Health Officers, established an Advisory Committee on Influenza Research. This committee was asked, among other things, to consider and advise the Surgeon General on what further research might be undertaken to strengthen influenza control in the future and to suggest where such research might most profitably be done.

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Vaccines, 1919

"The only way in which we are to secure promptly acceptable evidence of the value of a bacterial vaccine is by the vaccination of only a portion of the individuals in a large group, holding the remainder as controls; age, sex, and conditions of exposure being the same in the two groups.

"On the other hand, a vaccine should not be condemned unless controlled as just indicated, and unless it has failed to show protective value when sufficient time has elapsed after the inoculation to make it reasonably likely that any immunity which may develop will have had an opportunity to do so.

"A large number of vaccines have been used, some made from the influenza bacillus alone, others from this in conjunction with pneumococci, staphylococci, and streptococci, and in various combinations; the failure of one does not necessarily mean the uselessness of others."

—G. W. McCoy, Director, Hygienic Laboratory, Public Health Service, Public Health Reports, May 30, 1919.

Role of the Commission on Influenza

FRED M. DAVENPORT, M.D.

SINCE 1940 the Commission on Influenza of the Armed Forces Epidemiological Board has been continuously engaged in investigations of influenza and has given special attention to the development of an effective method for prevention of this disease. The results of controlled field trials in 1943 and 1945 convincingly demonstrated the effectiveness of vaccination against influenza A and influenza B. Vaccination studies in 1947 showed with equal authority that vaccines of limited antigenic coverage were ineffective against the A′ variants prevalent that year and gave an unequivocal answer to the question, Are antigenic differences detected by laboratory methods of practical importance for immunization?

Despite the difficulty of conducting field trials in years of low influenza incidence, the results of studies carried out between 1949 and the spring of 1957 clearly demonstrated how to cope with the phenomenon of sudden major antigenic shifting. Vaccines containing the A′ variant were repeatedly shown to be effective against influenza A′ (*1*). During this period few studies on vaccine effectiveness were carried out under auspices other than those of the Commission on Influenza.

The vaccine trials have been only one of the commission's major functions. A chain of laboratories was established in 1942. These are still maintained to serve as listening posts for the early detection of influenza, to document its spread, and to provide virus samples to a central strain study center for antigenic analysis. This system has been continuously productive of valuable epidemiological information. For example, in 1943 scattered local outbreaks of influenza A were identified in the spring and early summer before the extensive epidemic began in November of that year. In 1945, when the system was extended to include observations in most of the areas where the U. S. Army was engaged, a series of small outbreaks of influenza B, extending from March to the epidemic buildup in November and December, was traced in the United States and Alaska, in the Pacific and Caribbean theaters, and in Australia and South America. These observations revealed a year-long widespread prevalence of influenza B with a sharp fall and winter epidemic peak. The Army laboratories, and later the World Health Organization, have continued and expanded this activity into a vast network so that by now the point-to-point spread of influenza can be rapidly and accurately followed, and the data can be viewed in historical perspective. The summer occurrence of Asian influenza was therefore not a new finding and in itself did not herald catastrophe.

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Development of Influenza Vaccines

In addition to the laboratory observations, since 1942 studies made by the Commission on Influenza of the dimensions of antigenic variation of influenza viruses and their significance for immunity induced by vaccination or acquired by repeated infection have led to the recognition that the common antigenic components of influenza viruses provide a degree of cross resistance. The objective for prevention

of influenza by vaccination has become the development of a vaccine of broad effectiveness containing representative strains of the major antigenic families of influenza viruses (*2*). It was natural then for the commission to be deeply interested and involved when Dr. Maurice R. Hilleman, then chief of the Respiratory Disease Division, Walter Reed Army Institute of Research, reported that another major antigenic shift had occurred and that the new viruses were responsible for the severe epidemics reported from the Orient in April and May of 1957 (*3*). Promptly, a number of steps were taken by the commission to assess the significance of these events.

On the basis of the first epidemiological and immunological information available, it seemed quite unlikely that vaccines used in former years would provide optimal protection against Asian influenza. In a series of conferences held first with military and later with civilian health authorities, a program was developed for primary immunization against the new antigenic variant, using monovalent vaccines of the highest potency obtainable—at that time 200 chicken cell agglutination (CCA) units—to be followed in the military after a suitable interval by a booster dose of polyvalent vaccine containing the old as well as the new strains. The negotiations and the placing of a large order for vaccine by the military gave an essential impetus to vaccine production. Later, as part of the unprecedented effort directed by the Public Health Service in preparation for the current epidemic of Asian influenza in the civilian population, production of influenza vaccine was greatly expanded. Plans for effective use of vaccine were formulated, and successful methods were put into operation to maintain detailed surveillance of the spread and character of the influenza epidemic. These important developments comprise the most vigorous effort ever made to protect a population against influenza—the last great plague of mankind.

Influenza Surveys

In keeping with the traditions of the Armed Forces Epidemiological Board and its commissions, I made a reconnaissance early in June in Australia, the Philippines, Japan, and the Hawaiian Islands to gain first-hand information from virologists, clinicians, and military and public health agencies about the impact of Asian influenza in these areas. At that time, when rumor was rife but facts were difficult to acquire, it was found that the disease was widespread although clinically mild. The influence of crowding on the incidence of Asian influenza was quite apparent. The influenza attack rate in Navy personnel stationed on ships was clearly higher than in those based on shore, who, like the personnel of the Army and the Air Force, had the benefit of a larger number of cubic feet of air space per man. The incidence of influenza was obviously higher in the lower socioeconomic groups of the countries visited, those groups who lived in closer proximity to each other than did their more fortunate neighbors. Moreover, it was learned that Australia had been seeded with influenza early in its winter season; yet no catastrophic epidemic had resulted. The influence, then, of cultural factors on the severity of epidemic influenza was again shown.

The fatalities in the Orient, reported in the press without appraisal, were found to be concentrated in the very young and in the old-age groups. Moreover, the attack rate by age followed the familar pattern, being highest in childhood and becoming progressively lower thereafter. Finally, considering the number of deaths reported and taking into account the number of persons ill, it was apparent that Asian influenza was not a particularly virulent form of infection. It was reassuring to learn that, despite an attack rate of about 30 percent, there had been no disruption of essential activities in either civilian or military communities.

Later, in August 1957, a field study was established in Santiago, Chile, to observe the effects of Asian influenza in a country which ordinarily has a high incidence of pneumonia during its winter season. Dr. Harold B. Houser was the field director of this special study group, and the members were selected from personnel of the Commission on Influenza, the Commission on Acute Respiratory Disease, and the Commission on Streptococcal Diseases, Armed Forces Epidemiological Board. Chilean investigators collaborated most effectively in this effort.

The number of deaths from pneumonia occurring after influenza increased dramatically, but neither the case fatality rate nor the age distribution of pneumonia patients was different from other years—again there was no evidence of increased virulence of Asian influenza. There was just much more influenza, many more pneumonias, and hence a greater number of fatal cases of these diseases. In a careful study of about 50 fatal cases, it was found that approximately one-half showed evidence of staphylococcal pneumonia, while death in the remainder could largely be attributed either to overwhelming infection by organisms readily responding to early conventional treatment or to less intense infections in persons who had chronic disease involving vital organs. A small proportion of fatal cases were associated with infection in the last trimester of pregnancy. In a small number of cases the cause of death was recorded as hemorrhagic pneumonia, apparently without detectable secondary bacterial invasion. However, it was stressed that the pneumonia cases generally responded well to antibiotics.

The results of these field investigations were reported to the Surgeons General of the three armed services and to the Surgeon General of the Public Health Service. These reports served as timely and precise information to dispel rumor, to establish the pattern of the behavior of Asian influenza, and to forecast what might be encountered in the United States during the fall and winter of 1957–58.

Virus Strains of Asian Influenza

As time permitted, the question of the antigenic relationship of Asian strains to strains prevalent in former years was explored by studies carried out in the virus laboratory of the University of Michigan's School of Public Health at Ann Arbor. The information gained from the field trips and from other sources indicated that Asian influenza followed the familiar pattern of incidence by age outlined in former reports on the attack rate of influenza caused by strains similar to those of swine influenza (1918), by A strains (1943), and by A′ strains prevalent since 1947. The incidence of Asian influenza was highest in childhood and progressively lower in older age groups. The most plausible thesis yet presented to explain this phenomenon is that relative immunity in older persons is conferred not by highly strain-specific antibody but by a composite of antibodies built up by repeated exposure to other antigenic variants of influenza A (*2*). In consequence, then, persons having a composite antibody have a broad immunity to influenza even though their serums may show by conventional methods little or no hemagglutination inhibition (HI) antibody against the prevailing virus. To develop a composite antibody and a broad immunity by vaccination with several selected strains of virus has become one of the goals of the Commission on Influenza. It was important, therefore, to discover whether the relative resistance of older persons to Asian influenza could be correlated with detectable antibody.

The first significant report on the demonstration of antibody in the serums of normal humans came through Dr. Mulder from Leiden, Holland, who found respectable concentrations of antibody against Asian virus in the serums of a small proportion of persons 70–80 or more years of age (personal communication). This finding was promptly confirmed in Ann Arbor and elsewhere with serums obtained locally and, subsequently, with serums received from Dr. Mulder. Moreover, at Ann Arbor it was shown with pools of serums collected by 2-year age intervals that antibody detectable by complement fixation with Asian virus antigen was not present in persons below the age of 30 years but was usually present at low levels in those above 30. In addition, by hemagglutination inhibition, using special treatment of serums and antigen, low levels of antibody were frequently found at ages corresponding to those at which high levels of A′, A, and swine influenza virus antibodies are regularly present. There could be no doubt, then, that Asian virus was, antigenically speaking, not a completely "newe acquayantance."

This opinion was confirmed by observing the antibody response of four age groups to Asian virus vaccine given as 250 CCA units in 1 ml. subcutaneously (table 1). For this presentation, antibody levels are expressed as the geometric mean value of the groups studied, using final dilutions of serums for the calculations.

Table 1. Relation of age to antibody response after vaccination with 250 chicken cell agglutination units of Asian influenza virus

Age group	Titer	Frequency of antibody rise [1]
Children	[2] <32	3/25
Recruits	<32	2/23
Middle-aged persons	32	11/25
Persons over 80 years of age	281. 6	11/14

[1] Numerator—number of persons showing antibody increase even when an increase was found only in the next highest dilution of serums; denominator—number of persons studied.

[2] Geometric mean postvaccination hemagglutination inhibition antibody titers. Prevaccination titers were less than 32.

Children and military recruits showed no antibody increase as measured with the ferret-mouse-egg line of Japan 305 strain; middle-aged adults showed as a group antibody increase from less than 32 to 32. Eleven of the twenty-five subjects studied showed some antibody increase. However, in a group of 14 persons 80 or more years of age, antibody rose after administration of the same vaccine from less than 32 to 281.6, and 11 of the 14 subjects showed antibody rise. Four of fifteen other senior citizens showed a rise in influenza antibody when vaccinated with older strains.

In contradistinction to earlier explanations by other investigators, the accumulating epidemiological and immunological data strongly indicate that the high attack rate and ease of spread of Asian influenza do not reflect a total lack of immunity in the population. Rather, the data suggest that the capacity for rapid spread at high attack rates may be unrelated to the antigenic structure of the prevailing virus. This was certainly true when the A′ strains emerged in 1946–47.

From the serologic findings in the current experience, correlations can be made between the resistance of very old persons to influenza and the presence of antibody that reacts with strains of Asian influenza. Dr. Mulder first suggested that the virus involved in the pandemic of 1890 was closely related to Asian strains, and our findings lend support to his hypothesis. More importantly, they suggest that antigenic variation among influenza viruses has finite limits and that antigens formerly prominent are bound to be repeated as major antigenic components. This view supports the concept that ultimately a polyvalent composite vaccine can be given which will induce a broad immunity against influenza, an immunity that will no longer be jeopardized by sudden and unexpected antigenic shifting. The alternative is to pursue endlessly the futile course of trying with present methods to prepare a monovalent specific vaccine each spring to combat the unknown strain of influenza virus anticipated for the fall.

The Commission on Influenza was also concerned with defining the antibody response of humans to monovalent vaccines containing Asian virus because past experience had indicated that, while vaccination with the new strain was desirable for optimal protection, one could expect that antibody response and hence protection would not be optimal using the 200 CCA dose that was made the standard early in the summer. In brief, it seemed unlikely that an antigenic change in the strain would necessarily change immunological principles. Hence, owing to the increased yield of virus in eggs, as soon as vaccines could be prepared at higher unitage, studies were aimed at defining the dose-antibody response relationship in man to the virus of Asian influenza. The results of tests using vaccines prepared by 3 different pharmaceutical concerns by 3 different methods of manufacture are tabulated below.

Titer, by virus dose (units)	*Frequency of antibody rise* [1]
100 CCA:	
25.6 [2]	11/21
<32	0/22
200 CCA:	
28.8	14/21
23.0	4/23
51.2	11/21
29.4	16/25
400 CCA:	
83.2	18/20
35.2	16/21
750–800 CCA:	
83.2	19/21
74.2	25/25

[1] [2] See footnotes 1 and 2 to table 1.

NOTE: CCA=chicken cell agglutination.

Serums were collected before and 2 weeks after subcutaneous vaccination with 1 ml. of vaccine. Clearly, the frequency of antibody increase and the amount of antibody stimulated by vaccine of 100 to 250 CCA units were irregular and of low order. These poor results are like those observed in former studies when strains of influenza virus were given to persons who had not previously been exposed to these strains (*4*). With vaccines of 400 CCA units and above, antibody increase was more uniform and the postvaccination levels were, in general, higher. These levels approach those found in the earliest successful field trials of vaccination carried out by the Commission on Influenza but are lower than the levels observed in recent years with vaccines of higher potency. The data also imply that doubling the dose of virus from 400 to 800 CCA units does not commensurately increase the frequency or amount of antibody increase. Several members of the commission supervised the administration of most of these vaccines, collected the serums, and shipped them to the virus laboratory at Ann Arbor so that comparisons could be made under uniform conditions. The data were available by late August 1957 and were widely circulated. They supply one basis for the recent increase in potency of monovalent vaccine from 200 to 400 CCA units per dose.

Effectiveness of Asian Influenza Vaccines

The Commission on Influenza has now obtained the first specific information regarding the effectiveness of vaccines of varied potency against the current epidemic of Asian influenza. They indicate that protection is increased as the dose of virus is increased.

The studies summarized in table 2 were begun as soon as influenza vaccines of desired potency could be obtained in sufficient quantity. On July 26, 1957, Dr. J. O. Culver and Dr. Edwin H. Lennette began to inoculate 40 percent of the recruits newly assigned to training companies at Fort Ord, Calif., with monovalent Asian influenza virus vaccine containing 250 CCA units per milliliter. One milliliter of vaccine was given subcutaneously in this and in the following studies. Sixty percent of the men in each company received a placebo injection of formalinized saline. At the time the

Table 2. Clinical efficacy of vaccines containing Asian strains of influenza virus

Investigators	Vaccine [1]	Vaccinated			Controls			Estimated effectiveness (percent)
		Number recruits	Cases of respiratory disease [2]		Number recruits	Cases of respiratory disease [2]		
			Number	Rate per 1,000		Number	Rate per 1,000	
Culver and Lennette, Fort Ord, Calif.	250 CCA units, monovalent.	916	20	21.8	1,448	55	37.9	42
Meiklejohn and associates, Lowry Air Force Base, Colo.	200 CCA units, monovalent.	775	46	59.3	806	121	150.1	61
	400 CCA units, monovalent.	649	12	17.3	624	27	52.5	67
	Polyvalent with 400 CCA units, Asian.	564	9		[3] 614	38		
Rose and associates, Fort Dix, N. J.	200 CCA units, monovalent.	1,869	62	33.2	1,665	126	76.1	57
	750 CCA units, monovalent.	1,665	29	17.4				77
Gundelfinger and associates, Great Lakes Naval Training Center, Ill.	200 CCA units, monovalent.	1,080	43	39.8	1,444	234	162.0	75
	Polyvalent without Asian strain.	1,031	95	92.1				43

[1] CCA = chicken cell agglutination. [2] Predominantly influenza, not serologically identified.
[3] Type B influenza vaccine.

study was begun, Asian influenza was already prevalent at Fort Ord, and most of the patients with respiratory illness could not be admitted to the station hospital. Therefore, the effectiveness of the vaccine was measured by comparing the rate of dispensary visits for respiratory disease observed in the vaccinated and the rate in the unvaccinated populations. Cases of influenza occurring within 10 days after administration of vaccine or placebo were not considered in the evaluation because influenza was prevalent on the post at the time of vaccinating the recruits, and significant antibody increase would not be expected until 10 days after vaccination. For the period August 5–26 a rate of 21.8 cases of influenza per 1,000 recruits was found in the vaccinated group and a rate of 37.9 per 1,000 in the unvaccinated group, an estimated effectiveness of 42 percent.

At Lowry Air Force Base, Colo., Dr. Gordon Meiklejohn and his associates began their studies on July 29, 1957. Within 2 days, 775 airmen had received monovalent vaccine containing 200 CCA units per milliliter of an Asian strain of influenza isolated in Formosa. A placebo injection of formalinized saline was given to 806 airmen. The preparations were alternated within military units so that approximately 50 percent of the persons in each unit received virus vaccine and 50 percent, control material.

On September 23, a second study was established using three different influenza virus vaccines and a placebo preparation. In this study, 25 percent of the members of each unit received one of the following: (*a*) monovalent vaccine containing 400 CCA units of Japan 305 strain, (*b*) polyvalent vaccine containing 400 CCA units of Japan 305, 200 CCA units each of swine (A-1931) and Great Lakes (B-1954), and 100 CCA units each of PR 8 (A-1934) and PR 301 (A′-1954), (*c*) influenza B vaccine containing 400 CCA units of the Great Lakes strain of 1954, or (*d*) formalinized saline. About 600 persons received each preparation. The concentration of Asian virus in these vaccines is probably higher than in the vaccines used at Fort Ord, since independent measurements have indicated that the commercial laboratory which, upon request, prepared the vaccine for Lowry Air Force Base usually underestimated the virus content of their product.

At the end of July, when vaccination was initially carried out at Lowry Air Force Base, there was no evidence of the presence of influenza, but the disease appeared in the third week of September. Dr. Meiklejohn and his associates have analyzed the admissions to the hospital for acute respiratory disease from September 16 to October 27 for those vaccinated with 200 CCA units of an Asian strain of influenza virus and for the control group. The approximate protective effect was 61 percent. In the second study, no significant differences in the occurrence of respiratory infections were observed between the groups inoculated on September 23 during the first 10 days after vaccination. However, in the subsequent period the approximate protective effect of vaccines containing 400 CCA units of Asian virus appears to be 67 percent. Note the apparent increased effectiveness of the more potent vaccines containing 400 CCA units (table 2).

At Fort Dix, N. J., Dr. Harry Rose and his associates began vaccination of recruits on August 1, 1957, using two different vaccines. One contained 200 CCA units of Japan 305 strain per milliliter and the other, 750 CCA units. Companies of recruits arriving at Fort Dix were divided into thirds by roster, and each group received either 200 CCA units of virus, 750 CCA units of virus, or formalinized saline. The vaccination program was completed on September 6. A sharp outbreak of Asian influenza occurred at the end of September. Dr. Rose has tabulated the hospital admission rates for respiratory disease in each vaccine group from September 29 through October 20. The rate per 1,000 in the control group was 76.1; in those receiving vaccine containing 200 CCA units, 33.2; and in those receiving 750 CCA units, 17.4. The estimated effectiveness of the 200 unit vaccine was 57 percent and of the 750 unit vaccine, 77 percent. In this study, as in Dr. Meiklejohn's, the increased effectiveness of higher doses of virus for vaccination is clearly shown.

The Surgeon General of the U. S. Navy has provided information about the results of studies carried out at Great Lakes Naval Training Center, Ill., under the direction of Lt.

Comdr. B. F. Gundelfinger, Jr. Vaccination of recruits was carried out on August 10, 1957, using two vaccines and a control material. The first vaccine contained 200 CCA units per milliliter of Japan 305 strain of influenza virus. The second vaccine, the Armed Forces 1956–57 polyvalent influenza vaccine, did not contain an Asian strain. This vaccine was composed of 250 CCA units each of swine, FM1, and Great Lakes strains. Thirty percent of the study population received monovalent vaccine, 30 percent received polyvalent vaccine, and 40 percent received placebo. Illness clinically diagnosed as influenza appeared at Great Lakes in epidemic proportions during the week ending October 5 and continued through the week ending October 19. In fact, the admission rate for the week ending October 12 was higher than the admission rate for any week during the past 8 years.

The average admission rate of recruits for the 3 weeks was 162.0 per 1,000 in the placebo-inoculated group, 39.8 in the group receiving monovalent Asian virus vaccine, and 92.1 in the group receiving 1956–57 polyvalent vaccine. In this short interval the effectiveness of the monovalent vaccine was approximately 75 percent and of the 1956–57 polyvalent vaccine about 43 percent. If the apparent protective effect of the polyvalent vaccine is substantiated when the studies are completed, this information will add to the data now at hand demonstrating important antigenic relationships between the Asian strains and other strains of influenza virus isolated in former years. This result encourages the outlook for a practical composite vaccine of broad coverage.

Although the studies reported in table 2 are incomplete, the trends shown are sufficiently distinct to indicate the final effects of vaccination with vaccines of various potencies. These effects should be increased when laboratory studies identify and remove from the study cases of illness caused by other respiratory disease agents which are so common in recruits. Results of the studies emphasize, too, that vaccine of 200 CCA units gives somewhat less than optimal results, but that the effectiveness of vaccination can be increased by giving higher doses of virus.

Summary

This brief account of the role of the Commission on Influenza of the Armed Forces Epidemiological Board in studies of the epidemiology and prevention of influenza outlines the accomplishments of a group which has been working continuously and closely with the military since 1940 in the study of influenza as a disease problem. Largely by the efforts of this commission, the effectiveness of vaccination as a practical measure in preventing influenza has been firmly established, and the results of the commission's studies have given direction to the present effort to minimize the effects of epidemic Asian influenza.

Field studies conducted outside the United States on the incidence of Asian influenza in different age groups clearly showed the relative immunity of the older segments of the population to this disease. Laboratory studies carried out in Ann Arbor, Mich., and elsewhere have begun more clearly to define the antigenic relationships of current strains of influenza virus to older viruses and to demonstrate the antibody foundation of the relative immunity of the older age group. Field studies abroad also provided clinical, virologic, bacteriological, and pathological information on Asian influenza and its complications.

Finally, the results of the vaccine trials have provided the first specific evidence of clinical effectiveness of vaccine against the current epidemic of Asian influenza and have shown the value of increased dosages in providing more optimal protection against this disease.

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Laboratory Diagnosis of Asian Influenza

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MODERN STUDIES of influenza are dependent upon information obtained in the laboratory. Clinical impressions and epidemiological observations may suggest influenza. But until virus isolation or antigenic experience has been demonstrated, an etiological diagnosis cannot be made since many other agents can produce an influenza-like syndrome (*1*).

The role of the laboratory in defining and following the spread of an infectious agent has never been more dramatically shown than in the present epidemic of Asian influenza. From the time of the earliest antigenic analyses (*2, 3*) it was predicted that this new variant of the influenza virus would spread rapidly and that epidemics would occur throughout the world. It is the purpose of this report to describe the laboratory facilities which are now engaged in a large-scale operation aimed at providing definitive information about influenza. Some of the results obtained during these activities will also be presented.

Laboratory Network

The Laboratory Branch of the Communicable Disease Center, Public Health Service, began to intensify its work with influenza in 1955, and at that time, the Virus and Rickettsia Section accepted responsibility for an influenza center of the World Health Organization. In 1956, the CDC Virus and Rickettsia Section established a Respiratory Disease Unit at Montgomery, Ala., which was concerned with studies of influenza and several other viruses from the respiratory tract. This unit was designated by the World Health Organization to be the International Influenza Center for the Americas. In February 1957 this center sponsored travel for its director to the World Influenza Center in London for an exchange of concepts and discussions of problems.

The WHO influenza program consists of a worldwide network of collaborating laboratories and observers that report to the centers concerning the occurrence of influenza and forward virus isolates for antigenic analyses. This program was initiated in the United States in 1948 with approximately 40 laboratories participating.

Several State and Territorial health department laboratories have collaborated with the program during the past 9 years, and in the past few months, with help from CDC, many more of these laboratories have been able to participate in the program. There are now 45 health departments actively supporting the Public Health Service and WHO investigative projects. Currently a total of 135 laboratories are members of the American network. In the United States many of these are located at universities, institutes, and medically oriented organizations as shown below.

United States	115
State and Territorial health departments	45
Universities	39
Institutes	11
Hospitals	8
Municipal	6
Armed Forces	3
Drug companies	3
Canada	3
Central America	4
South America	13

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Laboratory Support Program

The pattern of providing financial and other types of assistance to laboratories, principally those of official health agencies, as later discussed, had been established earlier in the poliomyelitis diagnostic field. Anticipating a need for specific diagnosis of influenza, in order that accurate estimates of attack rates could be obtained, a basically similar program was planned by the Communicable Disease Center. This as executed consists of reimbursing official health agency laboratories for contractual services, which include establishing and maintaining facilities for isolating and typing influenza virus, maintaining serologic procedures, and reporting results of laboratory study of cases to the Center.

Certain academic or institutional laboratories have essentially similar types of contracts to provide this service to States, or to serve in a resource capacity in the evaluation of materials, procedures, or skills.

The facilities thus established are intended to perform functions expected to provide better intelligence on influenza than might otherwise be expected. The services of the laboratories will include examination of clinical materials from index cases of respiratory diseases in order that local influenza outbreaks may be early recognized. Since much influenza-like disease is prevalent, the workload involved in the early detection of influenza has been substantial. Additionally, the laboratories participating in the program are directing special efforts toward obtaining isolates, either viral or bacterial, from persons with severe influenza infections, and similar material from fatal cases that come to autopsy. All cooperating laboratories are participating in a technical evaluation of procedures and skills so that appraisal of the value of the different diagnostic techniques can be made and so that some estimate of the range in results of tests in the various laboratories can be determined.

Earlier Observations

Variations among type A influenza viruses have been studied for many years but significant antigenic differences and relationships have been most clearly demonstrated by field trials of vaccine. In the laboratory, results of antigenic comparisons of the different strains with cross-tests utilizing various antiserums have provided detailed information about shared antigenic components. It has also been possible to show that periods of prevalence for virus strains with particular major antigens are reflected in patterns of antibody titers in human serums from various age groups. These developments have been reviewed elsewhere (*4*). It was evident from these past studies that a new set of type A variants of the influenza virus could be expected.

One of the lessons learned during the past 15 years was that influenza vaccines could be relied upon to be effective in reducing the incidence of the disease only when the vaccine formula included strains representative of the prevalent set of viruses. Recognizing this, the World Health Organization established strain study centers with many strategically located surveillance laboratories with the view toward rapid identification of virus isolates from each new outbreak. The viruses thus obtained in Singapore, Formosa, and Japan during May 1957 were strikingly different from previous type A strains. The incidence of antibody against these viruses in human serums was extremely low. The expected new set of viruses had appeared and promised to spread uninhibited throughout the world population. Anticipating this, the WHO program participants and responsible military and Public Health Service officials were alerted, and within a week prototype strains were sent to vaccine manufacturers for pilot studies and to the collaborating laboratories so that each could become familiar with the characteristics of the new agent.

Diagnostic Reagent Program

Although many laboratories are capable of preparing the antigens and antiserums necessary for the diagnosis of influenza infections, a majority rely upon a central source for these materials. Since it was realized that early detection of influenza would depend upon the general availability of these reagents, in June 1957 approximately 100 laboratories were sent 15 ml. each of viral antigen prepared with the A/Jap/305/57, the A/Denver/1/57, and the B/GL/1739/54 strains. The last two strains are representative of recent variants of types

A and B. Antiserums prepared in chickens with each of these viruses were also distributed to laboratories in 5.0-ml. volumes. By the end of October, more than 30,000 ml. of antigen and 10,000 ml. of antiserum had been mailed to more than 300 laboratories.

Results of tests in July made it clear that the antigen prepared with the Japan 305 strain transferred serially in embryonated eggs was useful only in complement fixation (CF) tests and not in the hemagglutination inhibition (HI) method. Serum from patients convalescent from Asian influenza did not readily inhibit the hemagglutination of chicken erythrocytes by this virus. Meanwhile the virus had been instilled into the respiratory tract of ferrets, causing death, and infective suspensions of the lung were transferred serially in mice and later in eggs. This "animal-line" virus was much more sensitive to antibody in HI tests. Although mechanisms concerned in converting influenza strains from an antibody-insensitive phase to the more reactive phase are not understood, the phenomenon is well known and has been witnessed in many laboratories.

Another technical matter had to be dealt with, however, before the animal-transferred line of virus could be utilized. In addition to becoming more reactive with antibody, this line was also inhibited to a high degree by nonantibody substances in human and animal serums. The nonspecific inhibitors could not be digested with trypsin, but overnight treatment with solutions of periodate completely destroyed the troublesome inhibitors without markedly reducing specific antibody titers.

Therefore, beginning in August the antigen supplied to laboratories for the detection of Asian influenza antibody response has been that prepared with the egg-ferret-mouse-egg line (EFME). Directions for use of the antigen have been supplied. The viable seed for this Japan 305 variant and the other strains have also been distributed, and other materials, including human serums and normal allantoic fluids for control purposes, have been furnished upon request.

Information and Training Activities

Training in laboratory techniques in use at the International Influenza Center was provided in a 2-day workshop at the end of September. A class of 62 State and Federal technicians and directors was instructed in procedures to be followed in the isolation of influenza viruses from suspected materials. Standard methods for performance of the CF and HI tests were discussed and incorporated in laboratory exercises. Techniques for production of diagnostic reagents were outlined and considerable time was spent in discussing the interpretations of data.

The International Influenza Center met the problem of communicating pertinent recent information, or methodology, to laboratories by periodic newsletters and by collaboration with the CDC Influenza Surveillance Unit in the publication of a weekly influenza report.

Characteristics of Virus Isolates

The nature of this report does not allow a detailed description of observations made about the viruses isolated in the past few months. However, the following statements may serve to summarize the findings:

- All type A isolates obtained from various parts of the world since June are closely related antigenically to those sent from Singapore. The Asian set apparently has replaced the A′ or FM family. Approximately 200 type A viruses have been forwarded to the International Influenza Center during this time, and all have been readily typed as the Asian variety. Three type B strains have been received, and these are very similar to the B/GL/54 strain contained in polyvalent influenza vaccines.
- The rate of successful virus isolations has been extremely variable (from 0 to 100 percent) and is obviously dependent upon several prelaboratory factors, such as care taken in selection of patients, procedures followed in specimen collection, and transfer of specimens to the laboratories. In the laboratory, proper storage and treatment of specimens are necessary. Although the amniotic inoculation of 11-day embryonated eggs continues as the method of choice, many investigators have found monkey kidney culture useful (*5*). It is clear that amniotic fluids harvested from eggs should be tested with suspensions of guinea pig erythrocytes to detect the presence of hemagglutinating

virus. Often fluids shown to be negative with chicken erythrocytes were definitely positive with cells from guinea pigs. The value of subinoculating negative pools of amniotic fluids into another group of eggs has also been demonstrated. In several laboratories over 50 percent of the successful isolations were noted in this manner.

• Many of the positive fluids contained only low concentrations of hemagglutinating virus so that from 2 to 4 additional transfers were necessary before good titers could be obtained. Several strains have been obtained, however, which routinely reach titers of 1 : 800 or greater with 0.5 percent suspensions of chicken erythrocytes. Parallel tests of human serums with the Japan 305 strain and some of the more recent isolates have been carried out. One of these strains which yields higher titers may be substituted in the near future for the Japan 305 as the diagnostic antigen.

Serologic Diagnosis

Not all strains of influenza virus are equally sensitive to antibody in the HI or neutralization of infectivity tests. With the use of some variants the antibody response to infection in humans or animals cannot be demonstrated except by CF tests. On the other hand, many isolates have been studied which are as efficient as the Japan 305 EFME line supplied by the International Influenza Center. Mogabgab has found that fluids from infected monkey kidney cultures may also prove equally satisfactory sources of antigen (personal communication).

Many laboratories have reported diagnostic increases in antibody titers measured with A/Denver/1/57 or older type A influenza viruses in CF or HI tests although the isolates cultured from these patients were in the Asian set. These results are not surprising. The lack of specificity in antibody response to influenza infection, especially with CF tests, has been known for years. Repeated observations of antibody increases measurable in HI tests with strains of influenza virus no longer prevalent have led to the development of the "doctrine of original antigenic sin" (*6*). Although the mechanisms concerned remain poorly defined, it is clear from results of vaccination experiments and serum absorption tests that antibody response to related antigens is often conditioned by previous antigenic experience. In this epidemic of influenza some patients have responded by producing increased antibody titers against the older virus strains with no detectable production of antibody against the Asian set. Viruses obtained from these cases were always of the Asian variety. Therefore, serologic diagnosis cannot be relied upon as a means of defining the set of the infecting agent but only as defining the broader immunological type.

Comparison of number of antibody responses measurable by complement fixation or hemagglutination inhibition tests

Antibody response	Number	Percent
Total cases diagnosed [1]	123	100. 0
CF positive	94	76. 4
HI positive	76	61. 8
CF positive, HI negative	47	38. 2
CF negative, HI positive	29	23. 6
CF positive, HI positive	47	38. 2

[1] Fourfold or greater increase in antibody titer measured with either test.

The observations discussed above appear to lead to the logical conclusion that not much is to be gained by employing the HI test. The CF test will define the type of infection. The series of results compiled in the table, however, make it clear that both tests must be employed to effect a maximum of serologic diagnoses. Although the CF procedure was more often the more sensitive, many cases could not be diagnosed without the use of the HI method. Often high titers were found in the acute phase serum with the CF antigens while HI antibody was very low. In these cases the HI test is most useful. In a surprisingly low percentage of cases, only 38.2 percent, could the diagnostic rise be demonstrated by both tests.

Discussion

Legions of contributors to the store of knowledge about influenza have joined in an effort to study the characteristics of pandemic influenza. Although it is obviously too early at this time to define what has been learned, many laboratory

observations made during the past several years have been dramatically reconfirmed. The central role of the laboratory in providing etiological diagnosis of sporadic outbreaks and epidemics of influenza has been emphasized. Spread from country to country and within geographic areas has been carefully observed. There have been discussions in the past as to whether new variants appear simultaneously in several areas or the spread is from a single source. In the case of Asian influenza, at least, there can be no argument; the new variant arose in China and spread from that point.

Great interest has been focused on the question of whether strains of both the EM and Asian sets of A influenza would circulate. From June through November 1957 viruses isolated in great networks of laboratories all over the world have been of the Asian variety only. The greatest probability is that the older A sets will not be seen again in the near future. If the antigenic variations continue the course set during the past 24 years, we can expect modified forms of the Singapore viruses to appear and circulate during the next 10 years. The great shifts in antigenic composition of influenza viruses have occurred at least three times in our history at intervals of about a decade. Meanwhile, we can expect protection from influenza by vaccination or other antigenic experience with any of the Asian set of influenza virus strains.

Antibody response is often not strain specific in man because of previous conditioning by experiences with other variants of the immunological type. When epidemiological information is desired about more precise antigenic definition of the etiological agent, virus isolates must be examined. Although the serologic diagnosis of influenza is more frequently afforded by CF technique, a significant number of cases will be missed unless the paired serums are also tested by HI tests.

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Berlin Epidemic, 1889

"Professor Virchow has recovered from his attack of influenza; several members of the Imperial family have also been attacked . . . The *National Zeitung* is censuring those who spread pessimistic theories about the epidemic. . . . Official data of the number of cases of influenza here have not been made. It is known . . . that but few families have escaped the plague, and that a third of the population has been ill with it. The medical press refutes the theory that there is any connection between the influenza plague and cholera, although it is known to be a fact that cholera has repeatedly appeared after an influenza epidemic."

—Cable report from Der Deutscher Correspondent, Baltimore, Md., Public Health Reports, December 14, 1889.

Influenza Control in the Armed Forces

HERSCHEL E. GRIFFIN, M.D.

THE HISTORY of the Armed Forces' interest in influenza is long and generally well known. Certainly the World War I experience has been recalled often enough recently to indicate the concern at least that far back. During that period 1 in every 5 men in the Army contracted influenza, and roughly 25,000 died from its complications. This is nearly half the number of battle deaths in the American Expeditionary Forces. The disease is still potentially important to the military as well as to the population at large.

The modern history of the Armed Forces' activities directed toward the control of influenza dates from December 27, 1940. On that date Lt. Col. James Stevens Simmons, the late dean of the Harvard School of Public Health, wrote a letter recommending the establishment of a "Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army." Within 15 days approval was granted by the War Department, and the board, with its formidable title, was established. This agency, now the Armed Forces Epidemiological Board, and its Commission on Influenza are still active. The continuity of the agency is apparent from the fact that two members of the early commission are now on the board, one as its president, and two others are now directors of other commissions.

The major influenza control activities of the three military departments could be classified in several different ways. I have chosen to consider them under four main headings: surveillance, investigations, vaccination, and medical care. I shall briefly describe the activities of each of these areas and report our experience so far.

Lieutenant Colonel Griffin, MC, U. S. Army, is chief of the Communicable Disease Branch, Preventive Medicine Division, Office of the Surgeon General, Department of the Army. *This paper is based on comments at a symposium on Asian influenza held by the American College of Preventive Medicine and the health officers' section at the 1957 meeting of the American Public Health Association.*

Military Surveillance

Surveillance is maintained, as in civilian public health, by periodic reporting augmented by special epidemiological reports when the occasion warrants. For example, the Army has 176 stations around the world which submit weekly telegraphic reports enumerating new cases diagnosed. Common respiratory disease, influenza, and pneumonia are among the reportable categories. By this means trends may be determined and the overall picture seen. More detailed information is submitted by special telegraphic reports in outbreaks of respiratory disease.

Laboratory surveillance is based on the central laboratory at the Walter Reed Army Institute of Research and extends through the area laboratories in this country and overseas. Each has facilities for viral isolation and serologic identification.

Military medical facilities also participate in civilian reporting programs. Station medical officers comply with the State and local reporting requirements. In turn the three Surgeons General report their experience to the Public Health Service for publication in the *Morbidity and Mortality Weekly Report*. Coordination of effort among military, State, Public Health Service, and World Health Organization laboratories has been close from the beginning of man's ability to type the virus.

Through this surveillance an increasingly clear picture of Asian influenza among the military has emerged.

The most important characteristic of influenza to the military in 1957 was its high attack rate. This was the predominant feature of the early epidemics in Asian populations. But when the epidemic reached our military and naval units in the Far East, where we could focus closer investigative study, it became apparent that the attack rate was not constant. In some units the rate reached 65 percent, in others 10 to 20 percent, and occasionally there were only a few cases. This variation, it was soon determined, was not due to preexisting immunity since antibodies to this virus were entirely lacking in this group. It appeared to be a function of crowding and closeness of contact.

The high rates occurred in units where the men lived, slept, ate, and worked together, such as those aboard naval vessels and in recruit training camps. When the populations were not so concentrated, the rates were low. For example, the outbreak at the San Diego Naval Training Center began so explosively that many first thought it would turn out to be adenovirus disease. Moreover, the rates in recruits were high, and in the cadre, who lived in their own homes, the rates were low. But it *was* influenza. This pattern has now been repeated many times.

A companion feature has been rapidity of spread, or perhaps more precisely the almost simultaneous occurrence of geographically widely separated outbreaks. How the disease first swept through Asia is well known. Its successive occurrence in countries around the world and the early widespread seeding in the United States have been described.

The first confirmed military outbreak in this country occurred in an east coast naval station early in June 1957. For 3 months the laboratories across the country reported occasional virus isolations and significant titer rises from sporadic cases. But there were few outbreaks. Although the virus was widespread, the respiratory disease rate for Army troops in the United States remained relatively constant, below 100 per 1,000 per year in the weekly reports.

Then, in the first week of September, many special epidemiological reports were received. The rate for Army personnel in the United States rose in 5 weeks to more than 750 cases per 1,000 per year, as some 30,000 cases occurred. By mid-October, though, the rate was headed precipitiously downward again. At the end of the first week in December it was down to 215. Thus, although person-to-person spread may account for infection with the virus, it alone cannot explain the pattern of the occurrence of epidemic influenza in the Army. The pattern in naval fleet units is a little clearer because of the closeness of the contact and more nearly resembles the spread in Asia or the occurrence of disease in families.

If one focuses attention upon individual bases and ships rather than upon the armed services as a whole, an important mitigating feature of the disease is brought to light. This is the short duration of outbreaks. In military experience most have run their course in 4 to 6 weeks, except where there have been additions to the population. This brevity of duration significantly lessens the effect of even intense outbreaks. In those outbreaks where the overall attack rate reached 25 percent, only 5 to 6 percent were ill at the peak, and then for only a few days. Prevalence is a better index of impact of disease than is incidence.

The laboratory has contributed significantly to surveillance. Its first function is categorization of the outbreak through confirmation of the diagnosis. Our practice is not to submit every case of respiratory disease to the laboratory for study, but to investigate throat washings and serum pairs from a small sample of characteristic cases early in the outbreak. Once the outbreak is categorized as influenza, cases are diagnosed clinically.

Early in the summer it became apparent that "all is not flu that fevers." Outbreaks presumptively diagnosed as influenza were proved in the laboratory to be as diverse as streptococcal exudative pharyngitis, common cold, and salmonellosis. One wonders at the reliability of the cumulative numbers being generally quoted.

The laboratories have been examining the homogeneity of the virus. Remember that early in 1957 an influenza A′ virus was widely

disseminated. In April the Asian variant started its world tour. The question has been raised as to whether another strikingly different A virus would appear this year. Experience would say no, and so far the laboratory has borne out experience. But vigilance is being maintained for the early detection of the unexpected, should it occur.

Surveillance, then, has identified the close, continuous contact, such as that of the family or the crew of a ship, as the hazardous contact. Potential control measures involve preventing transmission of the virus within these close groups, rather than curtailing public gatherings. However, this does not preclude closing schools for administrative reasons because of high absentee rates or illness among teachers.

Investigative Efforts

Investigations are being carried out on many fronts so that when the time comes to draw conclusions about this epidemic, those conclusions may be based on data and not on speculation. We believe that we would be seriously remiss to allow this, the most significant occurrence of influenza in almost 40 years, to pass poorly or inadequately documented.

These investigations are being conducted at all levels. Prototype protocols for the epidemiological description of outbreaks at individual installations have been widely distributed. When they are returned, there will be a large body of information reported in comparable format, with data commonly categorized. We hope that this procedure will allow pooling of the data and permit an orderly and logical progression from the specific to the general when evaluations are made.

Military laboratories and research groups are also conducting studies. The early work of Dr. Maurice R. Hilleman and the Walter Reed Army Institute of Research group in identifying and categorizing the virus and in evaluating its antigenicity may be mentioned. Important work in clinical, laboratory, nursing, and other aspects of the situation is being done by other laboratories. We are continuing to finance the projects of the Armed Forces Epidemiological Board and its Commission on Influenza.

All this research, which represents a rather considerable commitment of personnel, facilities, and money, is not considered an ancillary function or an esoteric exercise, but an essential control activity. Just as the knowledge gained from the more than 15 years of previous study allowed prompt action when the new strains appeared, so the research carried out this year will continue to improve our position of preparedness for the future. At any rate, an effort is being made to avoid what Dr. Edward G. McGavran has categorized as the "loss of invaluable information through the failure to observe and record experience."

Vaccination by the Services

Vaccination represents the only really effective control measure available in combating influenza. The actual program of immunization is simple. Military personnel worldwide have received two doses of vaccine. Overseas, the same course was offered on a voluntary basis to civilian employees and dependent personnel. At installations in this country where supplies exceeded military need, one dose has been offered to dependents and civilian employees.

I have been asked to comment on the intracutaneous route of administering influenza vaccine.

The primary reason this route has been considered at all is that it enables the available supply of vaccine to reach a larger segment of the population. Hilleman and others have reported that the antibody response to intracutaneous vaccination was "almost as good" as the greater amount given subcutaneously. He noted that "this finding may be significant in situations where shortage of vaccine necessitates stretching the supply." Similarly, the special Committee on Influenza of the American Medical Association stated that the subcutaneous route was preferable, though the intracutaneous route was offered as a possible alternative.

In the Armed Forces all past studies and experience regarding the preventive effect of the vaccine, as opposed to antibody stimulation, have been based on the subcutaneous route. So this route was decided upon if the supply should prove sufficient. In one service, the supply for

the first dose was limited and the intracutaneous route was used in part of its personnel. The subcutaneous route was used throughout for the second dose.

As yet we have no data on the protective effect of the intracutaneous injections. Studies are under way to provide factual data on which to base future action.

Experiences in Medical Care

It is not customary to consider medical care a control activity. But in this disease care and control are interrelated. Clinical features have epidemiological significance, and epidemiology guides care. There has been nothing peculiar to the military in its hospitalization and therapy policies. Conservatism has been the rule. Segregation of patients, preferably without hospitalization for the uncomplicated cases, and symptomatic therapy with avoidance of antibiotics have been practiced in military as well as in civilian medicine.

The first action taken in medical care was obviously operational planning. It was necessary to estimate the capability of the military medical services in order to provide personnel, supplies, and facilities to meet the load. Because these medical services are designed for rapid expansion of their reserve capacity, and personnel and supplies are mobile, it was concluded that the capability was sufficient to meet the anticipated load.

The first test of this conclusion was in the Philippines. Clark Air Force Base reported a sharp, severe outbreak, but needed no outside help to manage it. Now that there have been scores of such experiences, it has become clear that the military medical services are indeed capable of handling outbreaks of this magnitude. Even aboard ship, where expansion capability is limited, facilities have been adequate, though at times severely strained.

Clinical experience may be briefly summarized. Cases have been acute, with temperatures averaging about 103° F. but recovery has been rapid. The average time lost has been about 4 days. Pneumonia diagnosed on clinical grounds has been seen in less than 1 percent of respiratory disease admissions. This includes primary pneumonia, with no association with influenza. In about 5 percent of the respiratory cases where chest X-rays have been taken routinely, some degree of pneumonitis has been reported.

Association of the influenza virus and a bacterial hitchhiker has not been observed, even in areas where streptococcal disease is endemic. In the Army one death has been associated with influenza. The few other pneumonia deaths have been intensively studied, but no evidence has been elicited which would indicate that influenza played a role in them.

In regard to the future, I can say only that this is our program; so far it has served us well. We intend to continue it as described, though ever alert to a change in the situation which would warrant modification or revision. We are prepared for such a change, while not necessarily predicting it.

Public Information and Education

J. STEWART HUNTER

ON SEPTEMBER 1, 1957, a New York newspaper carried a roundup story on Asian influenza with this lead sentence: "The greatest teamwork in medical history has been stimulated by the threat of a spread of Asian influenza this fall." Later in the story the reporter wrote: "Communications from Geneva [World Health Organization] through the world's capitals to laboratories, health departments, universities, vaccine manufacturers, local physicians, and the general public is the key to today's medical teamwork."

Undoubtedly the Nation's readiness with respect to Asian influenza owed its heaviest debt to intercommunication among nations, among medical and scientific and public health professions, between industry and government, and between all of these elements and the populace. The interchange of information has been constant since June 10, 1957, when Surgeon General Leroy E. Burney called the first meeting of representatives of medical and health professions to discuss the influenza epidemics then appearing throughout the Far East and to consider courses of action should the disease spread to this country.

In this effort the role of public information and health education as an organized and integrated part of the Public Health Service's Asian influenza program has been fully recognized and fully employed.

In testimony before the Senate Appropriations Committee on behalf of a request for supplemental funds for influenza activities, the Surgeon General said:

> In the last analysis, the success of any large-scale effort to control an influenza epidemic depends upon an alert and informed public. We must avert the dangers of indifference on the one hand, and of undue hysteria on the other. This calls for current and reliable public information on the exact nature of the problem and on the actions which need to be taken. We plan to provide these informational and educational services, in cooperation with State and local health departments and professional groups.

The Congress appropriated $110,000 for public information and educational purposes.

The Public Health Service has long recognized the importance of these activities, and information and public education are implicit in all its programs. In fact, the Service's basic legislation directs the Surgeon General to report on health matters periodically to the public and to the Congress, and to engage in health education activities. The Asian influenza program, however, represents a positive and explicit directive from the Congress to carry on an information campaign.

Two Related Tasks

In this campaign, there were two distinct but related kinds of tasks. The first was to inform the public about Asian influenza and to alert people to the possibility of an epidemic in this country and of the actions taken to deal with it. The second was to encourage use of the new influenza vaccine as the only preventive measure available.

The first task was essentially a public information program. Like all similar programs, it entailed not only reporting fully on developments as they occurred but an educational effort

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as well. The major emphasis was through mass media: newspapers, magazines, radio, television, films, pamphlets, and exhibits.

These facilities offer the most effective way of delivering a message to the eyes and ears of millions in the shortest possible time. This, of course, was the necessity which we faced. Information fully reported and properly interpreted through such media obviously is fundamental to the development of public understanding. There are, of course, many useful and essential channels.

The second task, to encourage use of vaccine, called for a sustained campaign of health education. In this campaign, the Service used both the mass media and the techniques of personal communication, although the emphasis, because of the limitations of time, had to be on the former. One of our important goals was to provide assistance to State and local health agencies, to professional groups, and to industry in their own information and health education programs.

To accomplish the first task, that of alerting and informing the public, the Service strengthened and intensified its means of imparting information through normal channels. For example, press releases were issued and press conferences were held immediately following all major policy decisions. Between June 7 and the beginning of December, the Service issued 35 press releases on Asian influenza alone, averaging more than 1 a week. In addition, the major meetings, such as the Surgeon General's special conference with the State and Territorial health officers in August, were open to the press and to representatives of other media. And, of course, State and local health officials, medical societies, and others interested in the program were kept regularly informed of incidence, vaccine supply, and other developments.

Considerable time and attention were given to working with magazine editors, staff writers, and free-lance contributors. Articles on Asian influenza have appeared in at least 32 magazines of wide national circulation, including *Reader's Digest*, *Life*, *Good Housekeeping*, and the various news weeklies. An incomplete tally shows that 60 such articles appeared from September through November 1957. In addition, there were numerous reports in specialized journals, trade magazines, house organs, and regional and State publications.

Papers and articles also appeared regularly in professional and scientific journals. Within the same 3-month period, for example, 14 articles on Asian influenza appeared in the *Journal of the American Medical Association*, several of them written by Public Health Service officials. There were similar articles in the periodicals of public health, nursing, pharmaceutical, and other professional organizations.

This was in line with another implicit directive from those who planned and administered the influenza program: a free and rapid interchange of information among professional groups. It was the job of public information and education personnel to apply their specialized skills and techniques to keep the information flowing and current. The material from the special meeting with the State and Territorial health officers, for example, was quickly reproduced and widely disseminated. The journals of the American Public Health Association, the American Medical Association, the American Hospital Association, the American Pharmaceutical Association, the nursing organizations, voluntary health agencies, and the State health departments spread the word rapidly to private physicians and other key people.

In fact, effective information services originated from a wide variety of sources and were conducted in an excellent spirit of cooperation. It should be emphasized strongly that the Asian influenza information program has been a cooperative enterprise throughout, with the noteworthy assistance of the communications industry itself. The reporting of the Asian influenza story by press, television, and radio, and by professional and specialized organs has been restrained, responsible, and enlightened. The newspapers and other media have almost without exception shown a ready understanding of the problems faced by health officials and a willingness to help.

A good example of this kind of cooperative action was a television program late in August on Westinghouse station KDKA in Pittsburgh. This program was produced by a joint effort of the television station, and the American Medical Association, the University of Pitts-

burgh, the Allegheny County Medical Society, and the Public Health Service. The participants included Dr. Burney and other officers of the Service, and Dr. George F. Lull of the American Medical Association. The show was carried in five major cities and over the educational television network of the University of Michigan. It was also kinescoped, and prints were sent to all the States. By mid-November, the film had been shown more than 200 times on 150 television stations in 41 States.

Many other television and radio appearances by senior officials of the Service, of State and local health departments, and of professional organizations also helped tell the story to the American people.

Films and Pamphlets Issued

In another information field, the Public Health Service developed extra footage and otherwise brought up to date a film made in 1950 entitled "The Epidemiology of Influenza." Copies of this film were distributed for use by the States. Reports received by the Service indicated that the film had wide use on television and at public and professional meetings.

A number of new publications on influenza were developed by the Public Health Service and given wide distribution. These included a fact sheet on Asian influenza, a revision of the basic health information leaflet on influenza, and pamphlets entitled, "What You Should Know About Asian Flu" and "If Asian Flu Comes to Your Community."

Pamphlets and other educational material were also issued by others involved in this effort. The American Medical Association developed a packet of material for State and local medical societies. The American National Red Cross issued a special Asian influenza information kit to its State and local affiliates. Voluntary health agencies, professional groups, the pharmaceutical organizations, and industry distributed special bulletins, pamphlets and articles for the general public as well as for physicians, pharmacists, and other health personnel.

Speaking engagements, including formal papers and informal talks before a variety of professional and public groups, helped inform additional thousands of people. Public Health Service officials delivered at least 23 addresses on Asian influenza from September through November, an average of about 2 each week. These were given in such major cities as New York, Boston, Philadelphia, San Francisco, St. Louis, and Chicago, and before groups ranging from local civic clubs to meetings of national voluntary and professional associations.

All of the foregoing, as well as other communications techniques, were used to perform the first of the two tasks previously mentioned, to inform the public. These techniques also served as an integral part of a sustained health education campaign. In addition, other educational measures were developed to encourage vaccination against the infection. All State health educators, for example, received guides on how to organize for local community action specifically adapted for this campaign. Health educators were assigned to the regional medical officers of the Public Health Service to work with States and communities and to conduct special surveys of local problems, needs, and attitudes.

A series of 14 radio spot announcements, 4 television announcements, and 5 newspaper advertisements in varying sizes were sent to public health educators and information personnel in all of the States and Territories for their use in local situations. In the 3-month period, 15 such mailings were completed. The materials were designed to be flexible and easily adaptable to the needs of local communities.

A great stimulus to the vaccination promotion program was a special campaign launched as a public service by the Advertising Council, Inc., in early November. Sponsored by the Public Health Service and the American Medical Association, the campaign was prepared by the voluntary task force advertising agency, Young and Rubicam, Inc. Its purpose was to carry the message of vaccination to all the newspapers and radio and television stations of the country. A kit containing four newspaper advertisements in varying sizes was shipped to all newspapers in the United States. Similar material was sent to all television and radio stations. The television spot announcements were narrated by the noted commentators, Edward R. Murrow, John Daly, and Dave Garroway.

Copies of related Advertising Council materials were sent simultaneously to State health officers and their health education staffs. Local sponsors of the messages were asked to check with their medical and public health authorities before using the advertisements in newspapers or on the air. In this way, State and local agencies were given an opportunity to participate in the campaign. Several local information and education efforts, in fact, were geared to the appearance of these ads.

In this effort, the Public Health Service had the benefit of early assistance and counsel from an ad hoc Advisory Committee on Information and Education, whose members were health educators in State and voluntary health agencies. The committee included Robert Yoho of Indiana, James Quinlivan of New York, Elizabeth Reed of Florida, Thomas Gibson of Georgia, Milton Kossack of Louisiana, and Sol Lifson of the National Tuberculosis Association. They responded generously to the request of the Public Health Service for advice on these matters and contributed substantially to the success of the program.

The Program's Effect

It is pertinent at this point to ask, and attempt to answer, the questions: Was the program successful? Did it achieve its purpose "to alert but not to alarm" the Nation and to encourage people to be vaccinated? The evidence seems conclusive that the campaign did indeed achieve its objectives. Probably never before in the history of the Nation has the public become so quickly and so well informed on a matter of public health importance.

The findings of the Gallup Poll of September 23, 1957, are worth repeating in this connection. Of the adults questioned:

92 percent had heard or read of Asian influenza.
76 percent knew that there was a vaccine against the disease.
65 percent planned to be vaccinated.

These findings are all the more remarkable when one considers the unprecedented speed of the entire influenza development. Within less than 5 months a new strain of influenza virus was identified and isolated; a new vaccine was developed, tested for safety and effectiveness, and produced in mass quantities; plans were developed and put into effect for a nationwide voluntary distribution system; millions of Americans were vaccinated; and an emergency medical care program was devised and put into effect in many local communities.

Communications paved the way for quick and effective action at every point in this development. Without a strong and active information program, the public might have floundered in ignorance and fear and there might have been uncertainty among professional groups. With it, there was a rational period of preparation and a cooperative mobilization of resources. This is not unique or even surprising. The American people, when well informed with the facts, react in this fashion.

The evidence of acceptance and understanding is clear. But was the job well done? Was too much information centralized in Washington, to the detriment of local programs? And was the entire development sensationalized beyond its public health significance either by the Service or others engaged in public information?

We believe that the answer to these questions is "No." While everything was done to alert people to the situation and to see that the information disseminated was accurate, it must be kept in mind that Asian influenza was not made into front-page news by virtue of a public information program. The story had many elements of newsworthiness: a disease of mysterious, sudden origin in a remote region, a rapid spread throughout the world, a catastrophic potentiality, and a unique scientific and industrial achievement of swift identification of a new virus strain and large-scale production of a new vaccine.

The problem was not whether to publicize the Asian influenza story. The story would have been told inevitably by the communications media because of its inherent public interest. The problem was instead to use the techniques of communication and education to let reporters, the public, and the health professions know precisely what was at stake, why action was necessary, and what kind of action

was called for by each group. And the aim was to draw each group into the national effort, as an active planner and participant.

Joint planning and joint action in the information and education effort as well as in other phases of the program were key elements in the control of Asian influenza. One of the important byproducts of this campaign has been the strengthening of relationships among those responsible for communications programs in Federal, State, local, and voluntary health agencies. This should stand us in good stead not only in the event of future emergencies but in the conduct of information and education for continuing health services. Information is vital to health programs, and its vigorous employment will help bring closer the goal of better health for all.

PHS Material on Influenza

The following materials prepared or issued by the Public Health Service relating to the epidemic of Asian influenza include films, publications, and articles in *Public Health Reports.*

Film

The Epidemiology of Influenza, an updated 1950 film (16-mm., sound, black and white, 13 min.), shows the fight against influenza since the pandemic of 1918. The historical significance, behavior, and periodicity of the disease, its clinical picture, the WHO program including the establishment of lookout posts, the physician's role in reporting, and laboratory procedures are all depicted. It can be obtained on loan from the Communicable Disease Center, Public Health Service, Atlanta, Ga.

Publications

Proceedings of the Special Conference of the Surgeon General of the Public Health Service with the State and Territorial Health Officers, August 27–28, 1957, mimeographed, available in limited quantities, without charge, from Public Inquiries, Public Health Service, Washington 25, D. C.

Public Health Monograph No. 48 (PHS Pub. No. 544), A Review and Study of Illness and Medical Care, with special references to longtime trends, by Selwyn D. Collins, 1957, 86 pp. (An extract from this study, Influenza in the United States, 1887–1956, covering pages 51–74, is published as a separate.)

Articles

The September, October, and November 1957 issues of *Public Health Reports* as well as this one carry papers on influenza:

In the September Issue—

Influenza Epidemic Alert, by Surgeon General Leroy E. Burney, p. 767.

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Mobilization of Private Physicians

HAROLD C. LUETH, M.D.

THE THREAT of an Asian epidemic in the United States confronted the medical profession early in June 1957. The board of trustees of the American Medical Association promptly designated the Committee on Civil Defense as the Special Committee on Influenza and assigned it the additional task of exploring the possibility of Asian influenza in the United States, the extent and nature of the threat, and the means with which the threat could be met.

On July 9, representatives of the American Medical Association, the American Hospital Association, and the Public Health Service met at the AMA headquarters to draw up a program whereby the individual physician could be informed of his role should the threat be realized.

As a result two principal programs were developed. One provided the physician with necessary information; the other dealt with organizational matters.

To assure the physician that he would get all the scientific information concerning the biology, epidemiology, clinical characteristics, and therapy of Asian influenza, the information program prepared articles and notices for publication in the *Journal of the American Medical Association* and special notices for State and county medical journals.

Dr. Lueth is clinical professor of medicine, University of Illinois College of Medicine, Chicago. He is a member of the American Medical Association's Council of National Defense, chairman of the Committee on Civil Defense, and chairman of the Special Committee on Influenza. *This paper is based on comments at a symposium on Asian influenza held by the American College of Preventive Medicine and the health officers' section at the 1957 meeting of the American Public Health Association.*

The organizational program was divided into several different activities. First, State and county organizations were notified and advised to take immediate action on the possible threat. One of the first things noted, of course, was that vaccination was the only possible means of combating Asian influenza. It was simultaneously recognized that the vaccine would be in short supply, requiring some scheme of allocation.

Next, the Special Committee on Influenza suggested that the vaccine be allocated on the basis of local determination, using the facilities and resources within communities. It was assumed that the local health profession working with the local public health officer and other community officials could best ascertain how vaccine in short supply could be divided and utilized advantageously.

An action group was then formed to allocate the determinable amount of hospitalization available. It was seen immediately that there would be a wide demand for hospitalization through Blue Cross, Blue Shield, and other insurance programs. Since it would be difficult for the physician to deny hospitalization to a large group of people, the committee felt that some scheme should be forthcoming for orderly use of hospitals.

Because of these problems, notification of the decisions were authorized by the board of trustees on July 20. At the same time, the board designated two of its members, Dr. Hugh Hussey and Dr. James Appel, to sit with the Special Committee on Influenza. By July 26, the notifications went out to each of the county and State representatives, and they were urged to take action.

It should also be pointed out that by July 20 there was some concern about a possible wide-

spread, injudicious use of antibiotics, and a preliminary statement was sought from the Council on Drugs of the American Medical Association. The council issued a statement advising a reasoned and cautious scientific application of antibiotics in proved and indicated cases.

On August 14, the Surgeon General of the Public Health Service called a meeting in Washington, D. C., for all representatives of national health agencies and voluntary health groups to decide how to cope with this particular problem. Three recommendations ensued:

First, the Surgeon General's program should be fully supported and endorsed by all organizations whose representatives were in attendance.

Second, local health groups or councils should determine how vaccine and hospitalization should be allocated within local communities.

Third, a meeting of the State health officers should be called by the Surgeon General at the earliest possible moment so that their efforts could be integrated or coordinated with other agencies.

The State and Territorial health officers meeting was held in Washington on August 27 and 28, and one of the essential ideas that came out of the meeting, in addition to those dealing with cooperation and allocation, concerned the proper use of laboratory work. There was some apprehension that physicians might not at first use the resources of laboratory techniques to pinpoint the occurrence of Asian influenza, but would rely on clinical signs. It was also feared that, in some instances, too much public awareness would lead overanxious patients and physicians to flood laboratory resources with an unnecessary number of specimens. A carefully worded statement urged physicians to use laboratory resources to determine the presence of an epidemic, but to allow the State and Public Health Service laboratory officers to select samples for testing.

The Council on Drugs, on September 7, enjoined physicians to use antibiotics only when indicated and then to use them in large enough doses to combat the offending secondary type of organism.

On September 19 the public information program was launched with a television announcement by the president of the American Medical Association. Recordings and scripts for radio and television were on hand for local members of the profession to use should influenza strike their communities.

By September 27 the program had developed and events had changed enough to warrant a second notification from the Special Committee on Influenza to the same county and State medical societies and health groups, advising them of current developments and again asking them to take appropriate action.

It is interesting to note that those medical societies with well-organized plans and with active national emergency medical service committees or civil defense committees quickly took this material, redefined it, reworked it in the light of their particular needs, and disseminated it to their local groups. Just to show how rapidly some States worked, the Mississippi State Medical Association was able to prepare and mail within 1 day after notifications were received a plan for the entire State.

On September 27 the Special Committee on Influenza took definitive action on the use of false and misleading information concerning the efficacy of drugs. As soon as Asian influenza received wide publicity, many took the opportunity to claim some therapeutic advantage of their particular pharmaceutical product. The Special Committee on Influenza emphatically restated that false and misleading statements about drugs should not be published.

On October 5 the Special Committee on Influenza reviewed the whole program and reemphasized its importance. While the committee was pleased that the program went on rapidly and efficaciously, it was cognizant of deficiencies and failings, and in an effort to have a more effective future method of operation each State and county medical society was requested to submit its particular program to headquarters of the American Medical Association. These reports will be carefully and critically examined as soon as possible in order to formulate a standby national program that will be useful should it be required in any future emergency.

In summary, what has the individual physician learned as a result of this program?

First, the physician has been profoundly impressed with the tremendous network and capa-

bilities of all governmental health agencies working in such close cooperation so as to make it possible to identify, isolate, and recognize this particular virus, and to make the information obtained readily available to physicians.

Second, the physician has recognized the importance of having channels of communication open to physicians whereby they can be alerted and quickly supplied with medical information.

Third, he has found that those physicians who had good immunization programs as part of their daily practice could incorporate the Asian influenza program without any difficulty.

Fourth, the thoughtful physician has discovered that his place in the community has been more thoroughly defined and delineated. He sees more clearly where he fits in relation to the local health officer, the professional agencies, and voluntary health agencies in carrying out his daily work as a physician.

Fifth, the physician has learned that the Asian influenza program is essentially an emergency medical service program and a phase of civil defense. A critical review of each physician's actions during the program should result in the adaptation of the best and most significant ideas for his daily practice, leaving those which are not a part of daily practice readily available in case they are ever needed again.

Mattison Appointed APHA Executive Secretary

Dr. Berwyn F. Mattison, secretary of health of Pennsylvania since 1955, has been named executive secretary of the American Public Health Association.

Previously, Dr. Mattison was commissioner of health in Erie County, N. Y., from 1948 to 1954, and in Yonkers, N. Y., from 1946 to 1947. He entered the New York State Department of Health in 1941, serving, during the next 6 years, as assistant district State health officer and district State health officer.

Dr. Mattison received his medical degree from McGill University, Montreal, Canada, in 1936, and his master of public health degree from Johns Hopkins University in 1941.

In addition to membership in numerous professional societies, Dr. Mattison holds a number of committee and board appointments including chairmanship of the Advisory Committee to the Surgeon General (PHS) on Training Needs in Public Health and of the Pennsylvania Advisory Health Board.

Lessons in Planning for Epidemics

MACK I. SHANHOLTZ, M.D.

GIVEN FOREWARNING of an epidemic of influenza, early planning is an obvious step. We have learned a great deal from the experience of planning for the present epidemic.

In working with the Asian influenza epidemic, we have learned some things that will be useful in planning for the total fight against influenza. In addition to what we know about the Asian influenza virus, the vaccine, and immunity through use of the vaccine, we have learned that cooperation between State and local health departments and State and local medical societies is necessary for the success of any program combating influenza.

I believe we have learned, too, what the health department's proper role is in such an activity. The health department acts as an information center, first of all, for the dissemination of educational material. It also acts as a central tabulation center on cases, distribution, and deaths. It helps in setting up priority systems for the vaccine as well as diagnostic facilities for the identification of the virus. And it helps organize community resources for stricken areas.

The experience gained from the present epidemic also suggests measures that should be undertaken—and others that should be avoided—in the event of another epidemic. Should that event come to pass, I should suggest the following:

Planning should be done by the two State groups most vitally interested and concerned in setting up a control program: the State health department and the State medical society. The first meeting for consideration of epidemic control should be limited to these two groups; larger groups of people, of whom some may not be too well informed, will serve only to waste time and create confusion. It is better that a small group devise the framework of a control program before calling in others to fill in the details. After the first meeting, however, allied medical groups, voluntary health agencies, and appropriate community groups should aid in preliminary planning.

In the event of another epidemic, State and local health departments and medical societies should present a united front to further a successful community control program. At the very outset, a State policy must be formulated covering all aspects of such a control program. Local groups can then plan programs for their respective communities within the framework of State policy. The State should also anticipate emergency needs and locate special resources.

I should recommend, as another important phase of planning, the development of an education program that would prepare every citizen for an epidemic. On this score, I might suggest that we begin at home.

As for educational materials, I feel it is necessary to have a special joint committee, with representatives of organized medicine on it, to appraise the various educational materials that might be sent out to the public. In the beginning of the Asian influenza epidemic we

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Dr. Shanholtz is the State health commissioner for Virginia. He is also secretary of the Association of State and Territorial Health Officers. *This paper is based on comments at a symposium on Asian influenza held by the American College of Preventive Medicine and the health officers' section at the 1957 meeting of the American Public Health Association in Cleveland, Ohio.*

were afraid of overselling and creating a panic. We were also afraid of creating a greater demand for vaccine than we could supply. A joint committee decided then, and should decide in the future, the quantity and timing of information.

Future epidemics could be handled more easily if local communities were organized, with certain variations to fit particular situations, very much like the States. Some community groups, of course, are already organized. Local health groups, such as health departments, medical societies, nurses' associations, and pharmaceutical associations, and voluntary health agencies, such as the Red Cross and civil defense groups, are examples. But there are other groups that could be organized more effectively; I mean those working in education, industry, and community affairs.

It might also be well to consider the reservoir of retired, inactive nurses that could be used more effectively. The Red Cross and civil defense agencies have listed them. I feel that we ought to have these nurses on a standby basis where they might assist in an emergency.

Other resources could be tapped. An epidemic calls into being a vital need for additional transportation and clerical personnel and emergency telephone services. It might also be worthwhile to consider providing nursery care for children of graduate nurses who are called to active duty.

My final recommendation concerns a better means of allocating vaccines, especially when the supply is far smaller than the demand. In the 1957 influenza epidemic, many people wanted vaccine and wanted to be first. Some managed to get vaccine in spite of priority grouping and advice. And some large groups received vaccine ahead of any classification. Some of the ensuing anxiety may be attributed to overeducation, but my own feeling is that much of the fear was engendered by a memory of the 1918 epidemic. In any case, a more coherent system of allocation is needed.

These are some of the lessons we have learned, as I see it, from the Asian influenza epidemic. Working together has been a very good exercise for all of us. We have learned again, above everything else, that a united, cooperative effort on the part of health officials and practicing physicians is all important for success in any endeavor in the field of public health services.

Emergency Recruitment, 1918

"Better than volumes of reasoned arguments, the present epidemic of 'Spanish' influenza has shown in concrete form how important it is to have attached to the United States Public Health Service a reserve organization which can be mobilized in times of emergency.

"With the widespread occurrence of influenza in the vicinity of Boston, and and the unmistakable signs of its beginning elsewhere, urgent calls were addressed to the United States Public Health Service to furnish medical and nursing relief to stricken communities. All available regular officers were detailed to the stricken communities, but the number available for such detail was insignificant compared to the urgent need occasioned by the epidemic. Moreover, the bureau had no nurses available for service in epidemic."

—*Public Health Reports, October 25, 1918.*

Research Programs on Asian Influenza

JUSTIN M. ANDREWS, Sc.D.

NEARLY a month before the first group of cases of Asian strain influenza were diagnosed in American civilians (high school conference at Davis, Calif., June 21–30, 1957), special research on various aspects of this disease had been started at the National Institutes of Health of the Public Health Service. Since then, 6 of its 13 major subdivisions, the Division of Biologics Standards, the National Institute of Allergy and Infectious Diseases, the National Heart Institute, the National Institute of Mental Health, the Clinical Center, and the National Institute of Neurological Diseases and Blindness, have participated in meeting this investigational exigency.

In late August, a special conference of State and Territorial health officers was called by the Surgeon General to review developments and to coordinate and plan future activities relative to the epidemic. At this meeting, the recommendation was made that a group of outstanding medical scientists representing the several areas of specialized knowledge associated with influenza be appointed to advise the Surgeon General regarding research planned to minimize the morbidity and mortality resulting from Asian influenza. This suggestion was implemented in September.

The following is a brief recapitulation of influenza research being carried on or supported by the National Institutes of Health and of the organization and accomplishments of the Public Health Service Influenza Research Committee.

Division of Biologics Standards

While influenza vaccine is not a new product and new strains have been added to the vaccine in the past, the vaccine situation faced by the Division of Biologics Standards and by the manufacturers in the early summer of 1957 differed from previous ones in the degree of urgency and in the size of the production goal.

Various isolates of the Asian influenza virus were supplied to licensed manufacturers of influenza vaccine by the Division of Biologics Standards as soon as they were received. The first of these, A/Jap/305/57, was sent out by the division on May 12, 1957. One of the immediate problems encountered with the new strain was the selection of a particular isolate which could be best adapted to producing satisfactory virus growth in the chick embryo. In addition to Japan 305, A/Jap/306/57, A/Jap/307/57, A/Formosa/1/57, and A/Singapore/1/57 were studied by both the division and the manufacturers for growth potential and other characteristics. As a result of these studies, it was decided that no particular isolate would be designated for vaccine production, but that the manufacturer would use, from among those distributed by the Division of Biologics Standards, the Asian strain isolate showing the best growth characteristics in the hands of the individual manufacturer. The type of potency test used with previous influenza vaccines had been of the mouse protection type which requires 4 weeks or longer to complete.

Initially, it was not possible to use this test for the Asian strain vaccine since a strain lethal for mice in sufficient titer had not been developed. Neither had there been sufficient

Dr. Andrews, director of the National Institute of Allergy and Infectious Diseases, was requested by the director of the National Institutes of Health, Public Health Service, to act as the focal point for all of the Institutes' activities concerning influenza.

time to develop information as to what constitutes an adequate level of antigenicity as demonstrated by such a test. In these circumstances, it was decided that since chicken cell agglutination (CCA) units per milliliter are related to antibody response, Asian strain influenza vaccine would be released on CCA values alone. This necessitated the development by the division of a CCA reference standard, which was furnished all manufacturers. It was then necessary for the professional staff of the division to work closely with the technical staffs of industry in order to standardize techniques and obtain uniform results in the performance of this test.

While vaccine continued to be released during the emergency on the basis of CCA values alone, efforts continued on the development of a mouse-adapted Asian strain and of a standard reference vaccine. By mid-August such a strain was developed and was furnished the manufacturers for trial potency tests in mice. By mid-November, when the production cycle of monovalent Asian strain vaccine was nearing conclusion and a return to production of a polyvalent vaccine was near, the division had developed and given the manufacturers a standard reference vaccine containing the Asian strain. On December 1, 1957, it was, therefore, possible to require again that potency determination be based upon the same antigenicity tests in mice as were required for all influenza vaccines prior to July 1957.

NIAID Projects

Scientists at the National Institute of Allergy and Infectious Diseases have a well-established and time-honored record of research activity on respiratory ailments, including influenza. Their current interest in the latter has resulted (*a*) in the development of a hemadsorption-tissue culture technique which facilitates and expedites the recognition of type A influenza virus (*1*), and (*b*) in the demonstration, by means of live-virus challenge experience in human volunteers, that the Asian influenza vaccines available in July 1957 conferred definite but not complete protection against infection and reduced the severity of infection (*2*).

For several years, studies of the characterization and epidemiology of viral agents have been conducted in three local orphanages or homes for children. In these institutions new respiratory and enteric disease agents are being introduced by newcomers and transmitted continually within the closed populations. Periodically, inmates are systematically sampled for pathogenic microbiota on arrival and during and after clinical episodes. Thus, it has been possible to follow with considerable precision the entrance, spread, and departure of specific microagents of disease. It was assumed in advance that these institutions would be invaded by Asian strains of influenza. Plans were made and are now being implemented for determining the epidemiological patterns of influenza outbreaks and the relation and significance to influenza of complicating disease agents under conditions of different levels of vaccination. The etiology of all severe and fatal cases will be studied intensively with particular reference to antibiotic-resistant bacteria.

Cases of unusual interest will be admitted to the Clinical Center for more sophisticated clinical investigations and determinations than are possible elsewhere.

Limited studies on pregnant women and infants are also under way at hospitals in the metropolitan Washington area. Hemagglutination antibody responses and local and systematic reactions to 1.0 ml. subcutaneous injections of 200 CCA units Asian strain vaccine are being evaluated in 51 women vaccinated during the 36th week of pregnancy. Their infants will be examined at delivery for hemagglutination inhibition antibodies. Some 30 newborn babies have been vaccinated with 0.1 ml. of 200 CCA units Asian strain vaccine, half of them subcutaneously and the rest intradermally. They, too, are being followed in order to detect antibody responses and reactions.

The National Advisory Allergy and Infectious Diseases Council at its meeting on June 27–28, 1957, exhibited lively interest and concern in the impending epidemic. The council unanimously affirmed a resolution proposed by its Ad Hoc Committee on Influenza emphasizing the moral obligation of the council to make available the means for studying the diagnostic,

clinical, epidemiological, therapeutic, and prophylactic aspects of the prospective epidemic. The council recommended to the Surgeon General that the national supply of reagents needed for the diagnosis of influenzal and complicating disease agents be augmented, and that additional support be sought for extending research grants and increasing the intramural influenza investigations of the institute. It further proposed that a conference of key research personnel be called to assist in planning and designing influenza studies.

Administrative plans for implementing these recommendations were approved promptly by the Surgeon General. Funds for intramural influenza research were made available, and the sum of $350,000 was reserved for influenza research grants. Laboratories and individuals with special interest and competence in respiratory disease study were encouraged to submit applications for research on various aspects of Asian influenza, with special emphasis on staphylococcal complications, and on evaluative studies of antibiotic prophylaxis against post-influenza pneumonia in high-risk patients, as recommended by the Public Health Service Influenza Research Committee. Some 40 requests for $618,566 were received and reviewed promptly by the Microbiology Study Section and the National Advisory Allergy and Infectious Diseases Council. Of these, 13 for $187,347 were approved for immediate payment. Subjects of investigation include serologic diagnostic technology, clinical aspects, therapy, basic viral studies, vaccine effectiveness under varying conditions of concentration and injection, complicating agents and conditions, etiology and virulence, epidemiology in community and institutional populations, and establishment in lower animals.

Heart Research Grants

At its meeting on June 20–22, 1957, the National Advisory Heart Council, recognizing the opportunity for studying some of the unsolved problems presented by the 1918–19 influenza epidemic concerning sudden, unexplained collapse and death, suggested that cardiovascular studies relating to influenza be encouraged. On July 12, 1957, a group of medical specialists was convened to discuss and advise regarding specific areas of research which should be supported. As the result of recommendations of this group, the council subsequently reserved $250,000 for special research grants for cardiovascular-renal studies of influenza and approved the establishment of a four-member Ad Hoc Committee on Influenza Studies under the chairmanship of Dr. George E. Burch, to stimulate, review, and make recommendations regarding grant requests.

This committee has recommended and the council has approved 6 research grants, 2 with supplements, in the prescribed subject area, committing $70,840.

NIMH Projects

The National Institute of Mental Health has joined with the Health Emergency Planning Unit of the Office of the Surgeon General, the Division of General Health Services of the Bureau of State Services, and the Army Chemical Corps in a cooperative study of the impact of influenza epidemics on community life.

The mental health and health educational authorities are interested in ascertaining group behavior, panic reactions, individual and mass motivations in the face of severe epidemics, and the capability under these conditions of the local government and voluntary groups of adapting their activities to cope effectively with the situation. The emergency planners want to determine the special health needs which must be met during unsuppressed outbreaks of disease, and the Army Chemical Corps is interested in ascertaining the levels of disability and absenteeism at which essential community services fail.

It is planned to hold periodic interviews with members of randomized samples of households in 3 cities of about 50,000 population in Pennsylvania and 2 more in North Carolina. Initial baseline data have already been obtained. Special contacts will be maintained with community health personnel, including physicians, nurses, and pharmacists as well as local health department representatives. The study will include similar consideration of transportation, communication, police and fire protection, school and industrial absenteeism, industrial

productivity and costs during epidemic conditions, accident rates and other circumstances and events reflective of the stresses, failures, and compensatory counteractions which occur during epidemics.

The National Institute of Mental Health has made a grant of $50,000 to a professional information-collecting agency which is conducting the weekly family interviews. Another $50,000 has been contributed by the Army Chemical Corps to help defray the costs of this research. Professional skills and services valued at $35,000 are being supplied by the Bureau of State Services for the direction, coordination, and analysis of this study.

Study of Vaccination Results

From September 3 to October 26, the Employee Health Service Branch at the Clinical Center of the National Institutes of Health offered Asian strain influenza vaccine to employees of the Institutes desiring vaccination.

Careful individual records have been maintained of the manufacturer, lot number, and concentration of the vaccine administered to each person. From subsequent reports of reactions, absenteeism, and the occurrence of influenza-like illness, it is hoped that information will be obtained on the frequency and severity of reactions and the relative effectiveness of the two concentrations of the vaccine in preventing lost work days due to influenza.

Some 6,000 adults of both sexes are involved, about 4,000 of whom were vaccinated subcutaneously at the Employee Health Service with material containing 200 or 500 CCA units. The nonvaccinated group is being sampled to determine the proportion vaccinated outside the clinical center. If this number is sizable, a survey will be made to separate the vaccinated from the nonvaccinated employees.

NINDB Projects

Knowledge of the well-established etiological role of certain filtrable agents, such as rubella and salivary gland virus, in congenital defects and abnormalities, led the National Institute of Neurological Diseases and Blindness to consider supporting extramural studies to determine whether or not influenza virus also may cause prenatal anomalies, especially of a neuropathic type. On November 16, 1957, a meeting of advisers was held at the National Institutes of Health to discuss plans and procedures for testing this hypothesis.

The group recommended that pregnancies be followed at large obstetrical services to find out whether prenatal abnormality rates were significantly higher if influenza occurred during pregnancy, especially in the first trimester. It was assumed that evidence of prenatal abnormality, including abortion, stillbirth, and fetal and neonatal malformations and anomalies, would be provided by the attending obstetricians, pathologists, and pediatricians. It was concluded that diagnoses of influenza could be made satisfactorily on the basis of standardized serologic tests supported by clinical evidence and certain knowledge that influenza was epidemic in the community when the respiratory illness occurred. The group advised that serum specimens be obtained from the pregnant women at least at registration or the first prenatal visit, at delivery, and, desirably, shortly after convalescence from any upper respiratory episode with fever. Conclusions regarding valid associations of influenza and prenatal anomalies would be based on carefully controlled statistical correlations.

In order to simplify and expedite supplementary financing for this study, it was agreed that these observations should be made, as far as feasible, at the five hospitals where NINDB cerebral palsy project collaborative studies are being made. Other institutions may be invited to cooperate later if additional data are required. The institute will act as the collecting and coordinating agency in handling and analyzing the pooled data.

Support of these studies is expected to be by contract during the initial phase of the project, later by research grants if feasible and indicated. Initiating expenses will probably not exceed $50,000. A large proportion of the total costs will be borne by the cerebral palsy project, of which these investigations are an integral part.

Research Committee Contributions

The Public Health Service Influenza Research Committee was established on September

26, 1957, in response to a recommendation made to the Surgeon General by the State and Territorial health officers at the special conference on influenza held August 27–28. The committee chairman is Dr. Colin M. MacLæod and there are 14 members. The purposes of this committee are (*a*) to review influenza research conducted or supported by the Public Health Service and other Federal organizations, (*b*) to identify areas where current research on influenza is lacking or deficient, and to make recommendations regarding more adequate coverage, and (*c*) to act in a liaison capacity between influenza research workers in or supported by the Public Health Service and those in or supported by other Federal agencies.

At its first meeting, held September 27, 1957, the committee heard and discussed detailed reports of various representatives of groups engaged in or planning research on influenza in 1957–58. On the basis of these presentations, the committee was able to identify areas of subjects in which more work should be undertaken. These included (*a*) the standardization of hemagglutination inhibition test reporting and methods of determining CCA values of vaccine, (*b*) assessment of the stability of Asian influenza vaccines in terms of CCA unit values, (*c*) animal tests for the antigenicity of these vaccines, (*d*) the efficacy of intracutaneous vaccination, (*e*) data concerning bacterial complications, especially staphylococcal, (*f*) clinical management of influenza patients with complicating infections or conditions, (*g*) controlled studies of Asian strain vaccination in patients with chronic pulmonary and cardiac diseases, (*h*) possible use of attenuated live virus influenza vaccines, (*i*) effectiveness of available vaccines in protecting against natural infection with Asian influenza virus, and (*j*) problems of vaccinating children against this strain of influenza.

The committee recommended that (*a*) the Public Health Service make adequate funds available as soon as possible to collaborating, nongovernmental laboratories for utilizing their resources in a collaborative study on epidemic influenza on a nationwide basis, (*b*) the National Institute of Allergy and Infectious Diseases use remaining reserved influenza research grant funds for studying staphylococcal complications of influenza, and (*c*) the Communicable Disease Center supply on request information concerning laboratories in the United States willing and able to provide reference staphylococcal typing service.

A Subcommittee on Therapy and Management of Asian Influenza and Its Complications was formed with Dr. George E. Burch as chairman. This was co-sponsored by the American Medical Association through its Committee on Influenza. A meeting of the subcommittee was held in New Orleans on October 29, 1957. The extent and pattern of the epidemic and of associated mortality was reviewed. Information was presented and discussed concerning the more common clinical manifestations and serious complications. The following recommendations were made and transmitted to the Public Health Service Committee on Influenza Research:

1. High-risk influenza patients—that is, those with chronic cardiac or pulmonary disease, persons over 60, and pregnant women—should receive prompt and adequate therapy at the first sign of influenza.

2. Grants should be stimulated for controlled studies to evaluate in high-risk patients the prophylactic administration of antibiotics (erythromycin and chloramphenicol advocated) or other chemotherapeutic agents to prevent complicating bacterial pneumonia.

3. An ad hoc committee should be appointed on pneumonia and deaths associated with Asian influenza to establish standard clinical, microbiological, and pathological criteria for determining influenza association, etiology of pneumonia, and cause of death, and to compile the results of applying these criteria during the current epidemic year.

4. Numerous small clinical studies should be made of the pathological physiology, course, and management of Asian influenza.

5. Serious consideration and long-term support should be given to research on the acute infections in people of middle age or over, studies being made to determine physiological and biochemical alterations to be derived therefrom.

The committee emphasized need for thorough and early diagnostic procedures, particularly chest X-rays, in persons presenting pro-

longed and complicated courses following influenza.

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films

"For the Nation's Health"

16-mm. filmograph, color, sound, 15 minutes. 1957.

Audience: Personnel in the health, medical, and allied professions, students, parents, teachers, counselors, civic groups, and the general public.

This Public Health Service orientation film presents a panoramic view of the activities of the principal health agency of the Federal Government. Combining photographs and motion picture film, it shows the growth of the Public Health Service from its inception in 1798, with limited care of sick and stranded merchant seamen, to its farflung programs today in hospital and medical care, in medical and biological research, and in public health.

Physicians, nurses, dentists, sanitary engineers, pharmacists, veterinarians, and a host of other skilled specialists are shown at work at home and abroad.

In Public Health Service hospitals and clinics, in well-equipped laboratories, on Indian reservations and other field assignments, and on Coast Guard duty, the range and variety of the work of the Public Health Service rarely fails to arouse interest.

Public Health Service personnel have been notified that the film is available to them, principally for training and orientation purposes, through the Communicable Disease Center, Public Health Service, 50 7th Street NE., Atlanta 5, Ga.

Others interested and Service personnel also may order the film on a short-term loan from the Surgeon General, Public Health Service (P), Washington 25, D. C. The filmograph may be purchased from Byron, Inc., 1226 Wisconsin Avenue, Washington 7, D. C. Cost of the print, $62.07, includes reel can, shipping case, and service charge.

Backsiphonage and Cross Connections: An Introduction

35-mm. filmstrip, color, sound, 11 minutes, 75 frames, 1957.

Audience: Sanitarian trainees and other public health personnel, including food handlers, and custodial and dining car personnel.

Many plumbing systems suffer from defects in design and installation. Backsiphonage and cross connections, two such defects, are both potential sources of waterborne disease epidemics.

This series of graphics, cleared for television, illustrates the significance to public health of backisphonage and cross connections, tells how to identify the basic causes, and shows the methods of prevention. It surveys the major situation in which the two defects occur.

This filmstrip may be obtained on loan from the Communicable Disease Center, Public Health Service, 50 7th Street NE., Atlanta 5, Ga., or by purchase from United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Public Health Problems In Mass Evacuation

16-mm. film, black and white, sound, 13 minutes, 462 feet. 1957.

Audience: Civil defense trainees in all phases of public health, schools, PTA groups, civic club members, and television viewers.

Mass feeding of evacuees poses serious public health problems

This motion picture showing public health problems attending the mass evacuation of an urban population emphasizes the magnitude of such problems as mass feeding, water supply, medical care, waste and sewage disposal, consequent disease outbreaks. Its objective is the motivation of discussion rather than the solving of problems.

This film may be obtained on loan from the Communicable Disease Center, Public Health Service, 50 7th Street NE., Atlanta 5, Ga., or by purchase from United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

The R. E. Dyer Lecture

Influenza

History, Epidemiology, and Speculation

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WE ARE FACED at the moment with the most publicized influenza epidemic of all time, and there is great diversity of opinion concerning its eventual course and outcome. Some, who believe that the present outbreak is no different from those that have appeared periodically since the 1918–20 pandemic, contend that it will come and go without any serious effects and that the public is being unduly alarmed. Others feel that the present outbreak bears some of the earmarks of the epidemic illness that occurred in the spring preceding the great influenza pandemic of the autumn of 1918 and that, as such, may constitute but the first wave of a more serious type of influenza to follow. Those who consider that this speculation may have some probability believe that the time has arrived when we must attempt to determine whether our knowledge of influenza is advanced enough to permit a serious attempt at combating it or whether we are still in a phase where all we can do is conduct further studies of pandemic influenza. The latter group are of the opinion that an intensive program of widespread immunization with a vaccine containing the new influenza virus strain should be instituted with all possible promptness.

The current epidemic of Asian influenza apparently started late in February of 1957 in Kweichow Province in southwest China. It spread to Yunnan Province in early March and was fairly well distributed through China by the end of that month. It spread to various

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parts of the Orient during the following 3 months and reached the United States about the middle of May.

In this country, the disease spread slowly, involving initially military establishments that had received personnel returning from the Orient. It appeared in various groups of civilians that congregated from different parts of the United States during the summer, most notably in summer camps and in a summer church conference at Grinnell, Iowa. Ill individuals returning from these meetings set up foci of infection in their home communities, and by late July and early August the disease was widely seeded throughout the United States. During the early part of the outbreak, Asian influenza showed little tendency to spread except on very close contact and tended to remain sporadic. With the beginning of autumn, the disease diffused more widely and rapidly than it had at first (*1*).

The symptoms shown by individuals ill with influenza, consisting of fever, depression, anorexia, and variable respiratory signs, have been relatively mild and have lasted for 2 to 5 days. There have been to date relatively few deaths attributable to Asian influenza.

Asian influenza has as its primary etiological agent a type A influenza virus which appears, on serologic grounds, to be antigenically quite different from type A influenza viruses that have prevailed in previous outbreaks, swine, A, and A′ (*2*). It would appear from this that the world is being exposed to a virus with which it has had little or no previous experience and that, theoretically at least, we should be ripe for an extensive outbreak with the new agent.

The marked antigenic shift in the Asian virus, the deficiency of antibody against it in humans, and its relatively rapid spread and high attack rates in the Far East are features of the new virus that alarm many people. In addition, a number of the deaths that have occurred in our country have been in young adults, the age group that was hardest hit during the devastating 1918–20 outbreak. The suggestion from all this is that the current influenza virus has epidemiological and pathogenic potentials that must be taken seriously.

To lay groundwork for speculation about the possible course and outcome of the present outbreak of so-called Asian, or Far East, influenza, I should like to review briefly a little of what is known of past influenza pandemics. No one knows when pandemic influenza first appeared, although Hirsch (*3*) dates its initial recognition to the year 1173. Since then it has recurred at irregular intervals under various names: febris catarrhalis epidemica, tussis epidemica, and finally influenza. The most recent pandemic, that of 1918, was by far the most deadly ever experienced. During the 4 autumn months that it prevailed, it caused some 21 million deaths throughout the world. Nearly half a million of these occurred in the United States. Thus almost three times as many people died of pandemic influenza as lost their lives during the 4 years of World War I, which ended just as the 1918 pandemic was passing its peak.

I have selected three outbreaks of pandemic influenza to discuss, for comparative purposes, and to use historically in connection with my consideration of the present influenza outbreak. I have chosen one from olden days, before the speed of modern travel entered to confuse the epidemiological picture (1789), one from the beginning of the bacteriological era (1889), and one modern one (1918).

Pandemic of 1789

The 1789 outbreak of influenza as it occurred in the United States was well described by Robert Johnson in his inaugural dissertation for the degree of doctor of medicine at the University of Pennsylvania in 1793. To orient you as to the time of this influenza outbreak, it came in the year that Washington was inaugurated President, that the first Congress met in New York, and that the French Revolution began. The first steamboat did not cross the Atlantic until 1819, and the first steam train did not run until 1830. Air travel, of course, was not even dreamed of. This outbreak occurred before modern means of rapid travel were available and when a man could go no faster than his horse could gallop. Despite this, according to Johnson, the influenza of 1789 spread like wildfire. It had the usual earmarks of later pandemics, being characterized by a prostrating illness of sudden onset and a febrile course of 4 to 5 days. Recovery was followed by several weeks of per-

Pandemic and Interpandemic Influenza

The term "pandemic" is ordinarily applied to a disease affecting or attacking all or a large portion of the population of a region: a disease extensively epidemic. Nothing in the usual definition of the term implies degree of severity. However, in current influenza parlance, the word "pandemic" has acquired a connotation of severity as well as extent of distribution. In this lecture pandemic designates a severe type of influenza such as that occurring in 1889 and during the autumn of 1918. The term "interpandemic influenza" denotes the milder type occurring between the pandemics at roughly 2-year intervals or oftener.

sistent coughing and prolonged debility in some instances. The attack rate was high, and the disease affected mainly persons in middle life.

The mortality rate was low, according to Johnson, and most patients recovered unless injudiciously treated. The suggestion was apparent in Johnson's paper that the treatment might frequently be more hazardous to life than the disease itself.

Now Johnson, in his definition of influenza, characterized it, among other things, as "a disease capable of being propagated by contagion." In spite of this conception, he could not completely rationalize the speed of its dissemination on the basis of transmission by contagion alone and visualized the importance of a "vicious quality of the air."

Johnson supported his contention about the spread of influenza by citing examples from the pandemic of 1782, in which he felt transmission by contact did not play the essential role. He stated, "Influenza appeared at London between the 12th and 18th, at Oxford in the third week, and at Edinburgh on the 20th day of May." He doubted that the disease could have been transferred to these three cities in such rapid succession "by things imbued with the contagion or by persons labouring under the complaint."

Later in his thesis he wrote, "On the 2d day of May 1782, the late Admiral Kempenfelt sailed from Spithead with a squadron under his command, of which the Goliath was one, whose crew was attacked with the influenza, on the 29th of that month: the rest were affected at different times: and so many of the men were rendered incapable of duty by this prevailing sickness, that the whole squadron was obliged to return into port about the second week in June, not having had communication with any shore, and having cruised solely between Brest and the Lizard."

Still another example was cited as follows, "About the 6th of May [in the same year 1782], Lord Howe sailed for the Dutch coast, with a large fleet under his command: all were in perfect health: towards the end of May the disorder first appeared in the Rippon, and in 2 days after in the Princess Amelia. Other ships of the same fleet were affected with it at different periods: Some indeed not until their return to Portsmouth about the second week in June. This fleet also had no communication with the shore until their return to the Downs, on their way back to Portsmouth, towards the 3d or 4th of June."

Johnson rationalized his views concerning the multiplicity of foci of origin of influenza during a pandemic by contending, "The morbific matter exciting the disease must have originated at some time and somewhere: and a cause like to that which gave rise to it in any one country, at any one point of time, might produce it in another country at the same time, under similar circumstances."

He continues, "I do not assert, nor do I wish to be understood to mean, that the influenza is not at all contagious: on the contrary, I am possessed of facts which prove in the most incontestable manner, that it may be, and often is, propagated from one person to another by means of contagion. But I mean, and the arguments which I have adduced, I trust, will warrant the conclusion, that the disease often does arise from some vicious quality of the air, or exhalation in it, as well as from a matter arising from the body of a man labouring under disease."

It is apparent that Johnson had certain difficulties in understanding and explaining the rapidity of spread of influenza. However, he did not have to make his views take into account the knowledge that influenza is an infectious

disease with a specific microbial cause, but instead could implicate various meteorologic abnormalities to explain incongruities that were beyond his comprehension.

I have gone into some detail in outlining opinions and observations concerning a premodern pandemic of influenza because I wanted to point out that influenza spread with unbelievable rapidity even before we had fast transportation to blame for its rapid and widespread diffusion and that, in the absence of such explanations to account for its dissemination, others, plausible at the time, were resorted to.

Pandemic of 1889–90

The first pandemic of influenza in the bacteriological era was that of 1889–90. Finkler (*4*) has written, ". . . this influenza epidemic broke forth from the East, and overwhelmed the world in a pandemic such as had never before been seen. The high flood of the pandemic flowed over the whole globe in the space of a few months." It started supposedly in Bukhara in Turkestan in the month of May, though influenza was also prevalent in Greenland and in Hudson Bay territory at about the same time. Influenza did not become widespread in 1889 until October, when it prevailed over most of Siberia and European Russia. There it was supposedly first confused with dengue and later referred to as Siberian fever. By November it was prevalent over most of the rest of Europe, and in December was widespread in England and America. In the United States, the disease raged for about 2 months before subsiding, and there were periodic recrudescences during the next 4 years (*4*, *5*).

There seems to be general agreement that this pandemic had most of the characteristics of the greater one in 1918 except for its lower fatality. W. T. Vaughn (*6*), who studied the 1918 pandemic and thoroughly reviewed the literature dealing with that of 1889, wrote in his monograph on influenza, "The longer one studies the observations made in 1889–93, the more firmly convinced one becomes that the recent pandemic (1918) was identical with the former in practically all of its manifestations."

The main finding of value from the studies of the influenza pandemic of 1889–90 was the discovery by Pfeiffer of the so-called influenza bacillus (*7*). Pfeiffer believed that this organism was the cause of influenza because, according to him, it was present in all cases and not present in normal individuals unless they had recently recovered from influenza. Furthermore, it was associated with the lesions of the disease. Pfeiffer's views were widely accepted, and it is safe to say that the majority of medical people at the time believed that he had discovered the cause of influenza.

The 1889 pandemic may turn out to be of especial interest in connection with the current outbreak of influenza. Studies of the antibody content for the Far East strain of influenza virus in serum samples from persons of various ages have resulted in some very unusual and interesting findings: it has been noted that only samples from individuals 70 to 90 years old contain antibodies for this new virus (*8*, *9*). This finding may date the time of last occurrence of a virus of the serologic type of the present Asian strains, and the age distribution comes suggestively close to placing the time in the neighborhood of the 1889 pandemic. Thus there seems to be a possibility that we are at the moment experiencing a revisitation of the 1889 pandemic strain of influenza. This is, of course, speculative.

Pandemic of 1918

During the spring of 1918 an influenza-like disease became prevalent in various parts of the world. This spring outbreak has been generally accepted as the first wave of the great 1918 pandemic. It is believed by epidemiologists to have been the immediate forerunner of the severe autumn outbreak which swept through the entire world with such deadly effect (*6*).

The first wave in 1918 received especial prominence in Spain, where it was said to have been sudden in its appearance and brief in its course, and to have subsided without leaving a trace. During April an illness similar to the Spanish epidemic occurred in American, British, and French troops in France, as well as in the civilian population. In England the first wave appeared in June and was composed for the

most part of mild cases (*10*). It affected simultaneously a large percentage of the population and showed a preference for individuals between 15 and 35 years of age. An influenza epidemic occurred also in Japan and China in the spring of 1918 (*11*). It was mild and was variously called "3-day fever" or "wrestler's fever," in addition to influenza. The spring wave of influenza was not highly diffusible; it reached only limited regions of Africa, largely missed South America, and affected Canada only slightly.

It is evident from accounts of the first wave that it was almost everywhere very mild so that although the morbidity was often high, sometimes amounting to 50 percent or more of the invaded population, the case fatality was exceedingly low (*10*). In many localities the general mortality rates were scarcely affected. In most countries the total number of persons contracting influenza seems to have been considerably smaller in the first wave than in the second.

The second wave, which proved to be extremely lethal, struck simultaneously in many parts of the world. It is generally stated to have appeared in Europe during the last week in August. In the United States it appeared first in Boston, supposedly from cases occurring on the receiving ship at Commonwealth Pier, during the last week of August also. During the next week it broke out among troops at Camp Devens in Massachusetts and sailors at the Great Lakes Naval Training Station in Illinois. Between the first and middle of September, hundreds of new foci appeared in various army camps, naval stations, and civilian communities. By the first week in October the pandemic was full blown throughout the entire world with the exception of a few islands and Australia. The height of the pandemic so far as this country is concerned was the fortnight between October 12 and 26 (*6*, *10*).

In the second wave, although there were many cases of the same mild type as in the first, perhaps as many as 80 percent of all attacks, a different manifestation of disease became prominent. This took two forms: (*a*) cases which started immediately with an acute pulmonary inflammation resulting in lung edema, violet cyanosis, and death within a few days, and (*b*) cases which developed on the fourth or fifth day of an ordinary influenza a definite bronchopneumonia which ran the usual course of primary bronchopneumonia of prepandemic times and was followed, accordingly, either by death or by a long convalescence (*12*).

Despite the fact that there was some divergency of opinion and considerable confusion concerning the epidemiological data, most epidemiologists believed that the 1918 autumn pandemic arose at 1 or 2 sites and from these spread throughout the world in a little over a month's time. It was commonly accepted, and there was evidence to support the opinion, that the pandemic in this country started in or near Boston (*6*, *10*). The cases responsible for the infection in Boston supposedly came from Europe, where the pandemic got under way very little, if any, earlier than it did in the Boston area. The infection was said to have been spread to other parts of the United States by the movement of patients among the civilian population or by the transfer of infected military personnel from one camp to another. The speed of spread was accounted for on the basis of the speed of available transportation. Certainly in a large number of instances, cited in the literature of the times, the onset of the disease in a community or a military establishment coincided very closely with the arrival of infected individuals.

However, certain discrepancies enter to spoil the perfection of the case-to-case transfer explanation for the spread of influenza during the second wave of the 1918 pandemic. These have to do with certain flukes in distribution, certain skips of large bodies of population. For example, Boston and Bombay had their epidemic peaks in the same week, while New York, only a few hours by train from Boston, did not have its peak until 3 weeks later (*10*). In like manner, Seattle, Los Angeles, and San Francisco had their epidemic peaks some 2 weeks earlier than Pittsburgh, which is just an overnight run from the infected eastern seaboard cities. In some respects, the epidemiologist had an easier time getting the pandemic disease transferred over long distances than in taking it to communities nearby. Thus, though it got to Chicago, presumably from Boston, fairly early and affected that city in September, it did

not reach Joliet, just 38 miles away, until October. Similarly, it took 3 weeks to cross the little State of Connecticut from New London County to Fairfield County (*10*).

In the light of these various epidemiological ambiguities one cannot help wondering whether perhaps more than one mechanism of dissemination may have been operating during the 1918 pandemic to account, on the one hand, for the lightning-like spread of disease over large distances and, on the other hand, for its slower diffusion over relatively small distances. The suggestion is apparent that extensive and widespread preseeding of virus in a masked or occult form, with its almost simultaneous provocation to infectivity by a stress common to wide geographic areas, might better account for the appearance of extremely rapid dissemination over great distances than does the view that case-to-case transfer was the responsible mechanism.

In swine influenza, a disease that I shall discuss a little later, the causative virus is preseeded in a masked, noninfective form by means of an intermediate host, the swine lungworm (*13*). Swine preseeded in this manner with occult virus remain normal to all outward appearances. However, all that is required to bring them down with influenza is the application of some stress of itself relatively innocuous. The stress, operative in nature for swine influenza, is meteorologic in character and is associated with the onset of cold, wet, inclement weather in the autumn (*14*). Swine that have been preseeded with masked influenza virus come down almost simultaneously in geographically widely separated areas when subjected to the same meteorologic stress, and the resultant widespread outbreak of influenza creates the illusion of being a disease that has diffused over an extensive area with unbelievable rapidity (*15*). Secondary cases of swine influenza follow at a more leisurely pace as a result of case-to-case contact with the primary, provoked infections.

I do not mean to imply, of course, that during the 1918 pandemic, the swine lungworm preseeded influenza virus in the human population. What I should like to suggest, though, is that influenza virus may be capable of existing in a masked form, similar to that found in the swine lungworm, in the human respiratory tract and that in such form it may be widely preseeded throughout a human population. It seems possible even that such preseeding may have been one of the functions of the milder, more slowly diffusing first wave of the 1918 influenza pandemic.

To return to further consideration of the 1918 pandemic, it may be said that, despite the apparent epidemiological discrepancies to which I have called attention, the opinion that direct and indirect transmission from man to man could account for the observed epidemiological picture of pandemic influenza was generally accepted. Whatever the correct explanation may be for the wide dissemination of the 1918 autumn pandemic, there is no doubt that the disease became very extensively distributed in short order. This second wave differed from the first in that it was more severe, more widespread, of greater dispersive power, and in some places at least, of a different age incidence.

The mortality rates recorded during the second wave varied widely among different groups and communities. The case fatality rate ranged from 3.1 percent in New London, Conn., to 0.8 percent in San Antonio, Tex. (*16*). Military personnel were especially hard hit, and Vaughn and Palmer (*17*) have stated that during the 4 autumn months of 1918, 1 of every 4 soldiers in the United States had influenza, 1 of every 24 developed pneumonia, and 1 of every 67 died.

Efforts to Prove Contagiousness

With all of the observed clinical and epidemiological evidence pointing to the likelihood that the 1918 pandemic influenza was highly contagious and spread from sick to well easily and apparently at the very first available opportunity, one would have anticipated that proof of its contagiousness by transmission tests in human volunteers would have been extremely easy. However, such did not prove to be the case: in not a single controlled experiment was it possible to demonstrate the transmissibility of the disease.

The most carefully planned and conducted experiments were those carried out by the Navy and the Public Health Service. In the series

of experiments conducted in Boston during November and December 1918, 62 volunteers between 15 and 34 years of age were used (*18*). Thirty-nine of these had no history of having had influenza at any time, although apparently some degree of exposure had occurred. Filtered and unfiltered secretions from the upper respiratory tracts of patients with typical influenza were sprayed into the nose and throat and instilled into the eyes of some of the volunteers; direct swabbing from nasopharynx to nasopharynx was the method of exposure for others; and in one experiment freshly drawn citrated blood was injected subcutaneously. The results were summarized as follows: "In only one instance was any reaction observed in which a diagnosis of influenza could not be excluded, and here a mildly inflamed throat seemed the more probable cause of the fever and other symptoms. Nothing like influenza developed in the other volunteers."

In an attempt to imitate nature more closely, 10 volunteers were exposed to patients with acute influenza in hospital wards. Each volunteer was placed very near the patient, shook hands with him, chatted with him for 5 minutes, and then received the patient's breath full in his face five times while he inhaled. Finally the patient coughed five times directly in the subject's face. Each volunteer did this with each of 10 different patients, all of them acutely ill for not more than 3 days. All patients used had typical acute cases selected from a distinct focus or outbreak of disease. None of the volunteers developed the disease.

A second series of similar experiments was carried out in San Francisco during the same period also with completely negative results (*19*).

These two groups of experiments were considered to show that the requirements for the transmission of influenza from man to man, such as apparently exist commonly under natural conditions, are not readily imitated experimentally. Actually they constituted probably a very good demonstration of how solid an immunity was conferred by even a subclinical bout with the etiological agent of the 1918 influenza.

Much work was expended during the 1918 pandemic in an effort to determine the causative agent of the outbreak. Prior to the 1918 studies, *Hemophilus influenzae* had been generally regarded as the agent responsible for influenza. It seems quite natural, therefore, that much of the 1918 investigative work should have been concerned with a further study of the relationship of this bacterium to the disease. The results obtained were frequently confusing and contradictory, which is not surprising in view of the fastidious character of the organism and the technical difficulties associated with its isolation from the respiratory tract. It is difficult to give an accurate appraisal of the significance of the large amount of work done during the 1918 pandemic in trying to prove or disprove the etiological relationship of the Pfeiffer bacillus to influenza. About all that can be said is that the role of the organism was more controversial after the smoke of the 1918 pandemic studies had cleared than it had been before.

With the failure to gain clear-cut evidence that *H. influenzae* was the cause of the 1918 pandemic, the view was rather widely held and was frequently expressed that a virus was probably the etiological basis for the disease. This actually constituted no more than an ungrounded opinion, for consideration of the data on the subject published from 1918 investigations reveals that no one adduced good evidence to incriminate a virus as the causative agent. The upshot of a terrific amount of effort during the 1918 influenza pandemic to learn the cause of the disease was to weaken the view that Pfeiffer's bacillus was the etiological agent and to substitute no other in its place.

I have just indicated that no one succeeded in determining the causative agent responsible for the 1918 pandemic influenza. This is not strictly true and what I should have said is that no investigator working in a laboratory did it. Actually Mother Nature stepped in and took care of the situation for us, as I shall now point out.

Swine Influenza

At the height of the second wave of the 1918 pandemic, a new disease appeared among swine in the Middle West. This new disease was not a sporadic and localized outbreak; actually millions of swine became ill and thousands died

during the first few months of its occurrence. The epizootic persisted in various localities until January 1919 and reappeared in the autumn and winter of that year as extensive and severe as in 1918. It has recurred each year since then, but it varies annually in its severity and extent.

Dr. J. S. Koen, an inspector in the Division of Hog Cholera Control of the U. S. Bureau of Animal Industry, was the first to recognize that the disease was different from any previously encountered (*20*). He was so much impressed by the coincidental prevalence of human influenza and by the resemblance of the signs and symptoms seen in man to those occurring in hogs that he become convinced that the two were actually the same. He therefore gave the name of "flu" to this new disease of hogs. The opinion of Koen that "flu" represented an entirely new swine epizootic disease and that swine might have been infected in the first instance from man was shared by some veterinarians and many farmers in the Middle West (*21*).

Everything was not rosy, however, with Koen's contention that a direct causal relationship might exist between the swine and the human diseases. The basis for the objections was largely economic since it was feared that, if it became widely known that swine could acquire human influenza, the pork-consuming public might become alarmed and the pork market would be adversely affected. Koen, however, was a fiery little man and, though frequently forced to defend his convictions verbally, stuck to them steadfastly. A year after his choice of what seemed a most unpopular name and diagnosis, he defended himself as follows (*22*):

"I have no apologies to offer for my diagnosis of 'flu.' Last fall and winter we were confronted with a new condition, if not a new disease. I believe I have as much to support this diagnosis in pigs as the physicians have to support a similar diagnosis in man. The similarity of the epidemic among people and the epizootic among pigs was so close, the reports so frequent, that an outbreak in the family would be followed immediately by an outbreak among the hogs, and vice versa, as to present a most striking coincidence, if not suggesting a close relation between the two conditions. It looked like 'flu,' it presented the identical symptoms of 'flu,' and until proved it was not 'flu' I shall stand by that diagnosis."

The late Dr. Paul A. Lewis and I began our studies of swine influenza during the autumn of 1928, and we were elated and pleased when we isolated from our very first cases of the disease an organism that was, so far as we could tell, like the non-indol-producing strains of Pfeiffer's bacillus (*23*). We named this organism *Hemophilus influenzae suis*. We isolated the same organism from field outbreaks of swine influenza again in 1929 and in 1930. It was the only organism we found with any regularity, and somtimes it was the only one present in the respiratory tracts of sick swine. Unfortunately, so far as assigning it etiological importance was concerned, *H. influenzae suis* administered in pure culture to susceptible swine produced no illness. We were thus faced with the dilemma of having found an organism that seemed always to be present in cases of the disease, that was demonstrable at the sites of the influenza lesions in the respiratory tract, but that failed to induce disease when administered to normal swine.

It was subsequently found that a filtrable virus, differing from any hitherto known, was important in the causation of swine influenza (*24*). This virus, however, was not the sole cause of swine influenza: when the virus was administered alone to susceptible swine it produced a disease that was clinically much milder than the true swine influenza as seen under natural conditions.

It was finally determined that swine influenza was a disease of complex etiology and that both the bacterium *H. influenzae suis* and the new filtrable virus were etiologically essential (*24*). We thus had in swine influenza a disease caused by the concerted activity of two agents, one of which, the bacterium, was strikingly like Pfeiffer's bacillus, long suspected by many of playing a causative role in human influenza. The other agent etiologically essential was completely new and did not, so far as anyone knew at the time of its discovery, have a counterpart in human disease. As it later developed, however, when Smith, Andrewes, and Laidlaw (*25*) demonstrated a virus as the cause of an in-

fluenza outbreak in 1933 and when this new virus was compared with the one from swine influenza, the two were found to be strikingly alike. They affected the same species of animals; they gave a high degree of cross protection against each other; and they could only certainly be differentiated from one another on the basis of certain serologic tests (*26–29*).

Thus in 1933 we had for consideration the intriguing situation of an animal disease of complex etiology, resembling influenza, in which one of the essential agents resembled the bacterium found extensively present in the second wave of the 1918 influenza pandemic and in which the other essential agent resembled the virus responsible for the then current interpandemic influenza. It seemed that, despite the failure of human investigators of the 1918 influenza pandemic to discover the cause of the outbreak, Mother Nature, using swine as her experimental animals, had done so. Furthermore, she had apparently segregated not one human agent but two from the disease of the severe second wave.

The late Sir Patrick Laidlaw (*30*) and I (*31*) summarized the indirect historical and experimental evidence bearing on the relationship of swine influenza to pandemic human influenza and pointed out that it strongly indicated the likelihood that swine had indeed acquired their infection naturally from man in 1918 and that the swine influenza virus was, therefore, the surviving prototype of the 1918 pandemic virus. Two further bits of experimental evidence have subsequently been developed in support of the hypothesis. In serologic tests conducted against swine influenza virus with serum samples from humans of various ages in 1935 and 1936, the results were such as to indicate strongly that an agent of the swine influenza virus type had been widely prevalent in man in the period from 1918 to 1920 and had not been present since then (*32*, *33*). In like manner, serologic tests conducted in 1952 (*34*) with swine influenza virus and the serums of humans of various ages again pinpointed the time of prevalence of an agent of the swine influenza virus type to the 1918–20 period. These two sets of studies, one carried out 17 years and the other 34 years after the 1918 pandemic, both orienting the time of prevalence of a virus of the swine influenza type to the period 1918–20, would seem rather effectively to support the view that swine influenza represents the surviving prototype of the agent that prevailed in man during the second wave of the 1918 influenza pandemic.

In brief, it seems to me that, from the swine influenza findings, one is warranted in speculating that the second wave of the 1918 influenza pandemic had as one of its etiological components a virus that was serologically closely related or identical to the swine influenza virus. It was, therefore, a type A virus not too much unlike the type A viruses with which we have had experience in the influenza outbreaks since 1933.

I am further going to assume for speculative purposes that the etiology of swine influenza as we know it today represents accurately the etiology of the second wave of the 1918 pandemic and that back in the autumn of 1918, when swine acquired their disease from man, the pigs effectively segregated the important etiological components of the human disease, namely, Pfeiffer's *H. influenzae* and a type A influenza virus. I hope that you will not consider this last assumption too illogical because to me it appears completely reasonable that, if an experimental host can select the etiologically essential virus, it might equally well be expected to select, from the mixture of micro-organisms that prevailed during the second wave of the 1918 outbreak, the etiologically important bacterium.

Evidence of Immunity

A question of very great interest to us right now, when we are in the midst of an outbreak of mild influenza which may turn out to be the first wave of a more severe outbreak, is what constituted the difference between the mild first wave and the severe second wave of the 1918 pandemic. I have speculated, on the basis of the swine influenza work just discussed, that the second wave of the 1918 pandemic was caused by a type A influenza virus, of which the swine influenza virus is the surviving prototype, acting in concert with *H. influenzae*. What then caused the first wave, and why was the first wave so much milder than the second one? Are there any data

from the investigative work conducted during the 1918 outbreak that might shed light on the relationship of the one wave to the other? I believe that there are and that they concern the question of immunity conferred by an attack of influenza during the first wave against infection during the second.

Because this question of the presence or absence of an immunological relationship between the first and second waves of the 1918 influenza has an important bearing on my speculations, I should like to cite several examples dealing with this point.

The Annual Report of the Surgeon General of the Navy for the year 1919 says in part, " . . . many men of the Navy who had influenza in the spring or summer of 1918, while in European waters, escaped during the later epidemics (winter 1918–19) both in Europe and the United States. The British Grand Fleet experienced the same thing: with few exceptions those men who contracted influenza in May and June were not attacked during the more fatal epidemics in October, November, and December. The conclusion is that mild attacks earlier in the year, as a rule, conferred immunity against the more fatal type of the disease which prevailed subsequently." With regard to the experience in the British Navy, Dudley (*35*) has pointed out that the crews of only certain ships were affected by the first wave, the crews of others escaping the infection. During the second wave the attack rate on the ships that had had the earlier infection was about 25 percent, while on those ships that escaped the first wave the attack rate was about 50 percent.

In most Army groups the outfits were moved about too much and transferred too frequently to furnish reliable records as to an immunological relationship between the two influenza waves in 1918. There are, however, large numbers of isolated records involving relatively small numbers of individuals. For instance, Gibbon (*36*) writes that of 400 patients with influenza hospitalized from among the 2,000 troops under his care, none admitted in June, July, or August was readmitted in October, November, or December, and none admitted in either of those periods was readmitted in February 1919. Dopter (*37*) reports recurrent epidemics in a French Army division of which he was surgeon in 1918. During the spring wave, toward the end of April, only the infantry regiment of the division was attacked, the artillery regiment escaping infection. In the fall a group of heavy artillery was attached to the division, bringing influenza with it. The disease spread, but only those not ill during the first wave were very seriously ill in the second.

V. C. Vaughn (*38*) cites the experiences of the 2d Infantry Regiment which underwent influenza in June of 1918 in Hawaii before being transferred to Camp Dodge about August 1. When the severe second wave hit Camp Dodge in September and October, the 2d Regiment was only slightly affected, although the attack rate for the camp as a whole was about 33 percent and the case fatality 6.8 percent.

Probably the most impressive example of immunity among troops is that related by V. C. Vaughn (*39*) for a division stationed at Camp Shelby. The division, numbering about 26,000, underwent a mild influenza epidemic of about 2,000 cases in April 1918. Vaughn comments as follows on the subsequent history of the division: "This was the only division that remained in this country without change of station from April until the fall of 1918. During the summer this camp received 20,000 recruits. In October 1918 the virulent form of influenza struck this camp. It confined itself almost exclusively to the recruits of the summer and scarcely touched the men who had lived through the epidemic of April. Not only the 2,000 who had had the disease in April, but the 24,000 who apparently were not affected escaped the fall epidemic. It appears from this that the mild influenza of April gave a marked degree of immunity against the virulent form in October."

Certain information about the civilian population also indicated an immunological relationship between the first and second waves of influenza. Malone and McKendrick (*40*) observed in Calcutta that three institutional populations who experienced infection during the July wave passed through two later waves, in December 1918 and February 1919, without contracting the disease a second time. They believed that their evidence indicated an im-

munity lasting for at least 9 months. The Inspector General of Health in Spain (cited by W. T. Vaughn, reference 6) reported that those cities that had the disease in May 1918 suffered lightly in the autumn, while cities that had been spared in the first invasion suffered most in the second. V. C. Vaughn (*39*) has pointed out that among the large cities in the United States having a low death rate during the autumn wave of influenza were a number that had reported an unusually high incidence of influenza and pneumonia in the spring. Jordan (*10*) has called attention to the fact that the attack rates in English towns during the autumn wave were only about half those prevailing in towns in the United States and comments on the temptation to account for the differences on the basis of the more sharply defined and extensive first wave which prevailed in England having conferred a more extensive immunity. W. T. Vaughn (*6*) in studies deriving from his house-to-house canvasses in Boston found only four instances of more than one attack of influenza among 1,971 cases occurring in his series between March 1918 and August 1919.

There are, of course, some examples in the literature which fail to show a clear-cut immunological relationship between the two waves. My reason for calling detailed attention to the examples indicating a relationship and neglecting those that do not is this: When one is seeking to show a positive relationship between two conditions of unknown etiology, a positive correlation is, because of diagnostic uncertainties, of much more value in indicating the true relationship than is a negative one.

It is apparent, I believe, from the examples I have just cited that, by and large, an attack of influenza during the mild first wave protected an individual against infection during the more severe second wave. Such a relationship strongly suggests that the etiological agents responsible for the two waves were either identical or so closely related immunologically as to cross-protect one against the other. Since what presumptive evidence we have indicates that a type A influenza virus of the swine influenza prototype was involved in the second wave during 1918, the assumption seems warranted from this immunological data that the same or a very closely related type A virus was also involved in the first wave. Why then, since similar influenza viruses were apparently of etiological importance in each of the waves, were the two waves clinically so different?

Role of H. Influenzae

A possible answer to this question, I believe, is supplied by the bacteriological studies of those investigators who sought to find the Pfeiffer bacillus during both waves of the 1918 pandemic. As I have pointed out, from the time of Pfeiffer's announcement of its discovery in 1892 until 1918, *H. influenzae* was generally regarded as the agent responsible for epidemic influenza. Because of this belief, much of the work done during the 1918 pandemic was concerned with a further study of the relationship of this bacterium to the disease.

In the light of this large effort to find *H. influenzae*, the marked difference encountered in the incidence in which it was demonstrated during the first and second waves by individual investigators who studied both waves was striking and suggestive. The findings of almost all were in agreement that the Pfeiffer bacillus was either absent or of low incidence in cases of the first wave and abundantly present during the second wave. Sobernheim and Novakovic (*41*), for instance, found Pfeiffer's bacillus to be practically absent from the early cases, whereas in the second wave they found it in pure culture in a large majority of the cases investigated (18 out of 23). Fildes, Baker, and Thompson (*42*) failed to find influenza bacilli in cases during July and August but found them during the autumn wave in the sputum of 12 of 15 uncomplicated cases and in practically all their postmortem material. Similarly, McIntosh (*43*) failed in the summer but found Pfeiffer's bacillus in the autumn in 8 of 12 examinations of the nasopharynx in uncomplicated cases, and in the sputum of 21 of 25 cases with bronchopneumonia. The experience of others both in Europe and in the United States was similar (*44–47*).

In this country, for example, Opie, Blake, Small, and Rivers (*47*) found that the incidence of Pfeiffer's bacillus in normal individuals from isolated communities, or in groups free from respiratory disease prior to the occur-

rence of the 1918 autumn epidemic, was relatively low (10 to 20 percent), but that before the fall epidemic, in groups in which bronchitis and pneumonia were fairly prevalent, the incidence was higher (25 to 50 percent). During the epidemic the incidence rose to 95 percent.

I believe it can be safely said that, so far as the bacteriology of the first wave of the 1918 influenza epidemic can be used as a criterion, Pfeiffer's bacillus was not demonstrated with enough frequency to support its claim as a causative agent. Its presence probably about coincided with its distribution in healthy persons at the time that the first wave appeared. During the second wave, however, the organism appears to have been found with great regularity.

In summary then, it appears that the Pfeiffer bacillus was absent or of low incidence in cases of the first wave and was almost uniformly present in cases of the second wave. How then could these differences in the bacterial flora during the two waves have influenced the severity of a disease caused by a type A influenza virus? Here I must again revert to consideration of swine influenza for a possible answer to this question.

As I have indicated earlier, infection of swine with the swine influenza virus alone results in an extremely mild respiratory disease of 2 or 3 days' duration from which the animals uniformly recover. However, swine infected with the swine influenza virus in combination with *H. influenzae suis* undergo a severe prostrating, febrile illness of 4 or 5 days' duration, frequently accompanied by pneumonia, from which death results in about 3 percent of all cases. In swine, then, the disease caused by the swine influenza virus alone resembles, in its mildness and other clinical characteristics, that seen in man during the first wave of the 1918 influenza, while the disease caused by a concomitant infection with the virus and *H. influenzae suis* resembles that seen during the second wave of the 1918 influenza. Furthermore, swine recovered from the mild ailment caused by infection with the virus alone are solidly immune to the more serious disease caused by infection with the virus plus *H. influenzae suis* (*48*).

It seems apparent, if the analogy between swine influenza and the 1918 influenza pandemic is an acceptable one, that the mild first wave of the 1918 pandemic can then be interpreted as one in which only a type A virus of the swine influenza prototype was involved. The second wave, on the other hand, was one in which the infection was a complex one, involving the same or an immunologically closely related type A virus and *H. influenzae*.

Applications to Present Outbreak

Let us now return to the current Asian influenza outbreak. If this outbreak is eventually to reach serious proportions, we appear at the moment to be in what in 1918 was the first wave. The cases ordinarily are not severe, and the mortality rate is relatively low. So far as I am aware, the Pfeiffer bacillus is not being isolated with any regularity from cases, and certainly it has not been reported to have been present in cases that have come to autopsy.

The current influenza may be considered on clinical grounds to be similar to a number of the outbreaks of interpandemic influenza that we have experienced since 1932 or to the first wave of the 1918 pandemic. We have no way of knowing at the moment whether it will be followed by a second wave of greater pathogenicity, as was the first wave in 1918. The fact that the human population is, in this outbreak, experiencing infection with a virus with which it has had no previous experience, to judge from the absence of specific antibodies, suggests that we may be ripe for a continuation of the present epidemic into a severe and killing second wave, but I do not think that anyone is, at the moment, in a position to predict accurately on this point.

Now, in the light of the speculations in which I have indulged, I should like to outline briefly my views as to how the present outbreak should be handled from a practical standpoint.

I believe it would be very foolish not to take full advantage of what means we have to protect ourselves. By this I mean that vaccination against the current epidemic strain seems to me to be strongly indicated. I think it is especially urgent that those who have apparently missed clinical infection during the early part of the present outbreak be immunized, since

they may be the very ones in whom occult virus has been preseeded. We have waited a long time to learn whether, when the next pandemic came along, we would be in a position to combat it, or only in a position to study pandemic influenza further. If we do not vaccinate widely and effectively and a second wave of severe influenza should appear, then undoubtedly we shall have copious opportunity again to study pandemic influenza. If we do vaccinate now, the most valuable information that can be derived will be whether or not we have finally gotten ourselves into a situation where we know that we can protect against outbreaks of pandemic influenza.

One frequently hears the view expressed that if another pandemic of severe and killing influenza occurs, the antibiotics can handle the situation satisfactorily by taking care of the lethal secondary bacterial invaders. Now this may be quite true for most of the commonly thought of complicating organisms. However, if *H. influenzae* should happen to be of importance, I doubt that we as yet have sufficient experience in treating infections of this organism in adults to be certain on this point. Although chloramphenicol, streptomycin, and the tetracyclene antibiotics have been effective in *H. influenzae* infections in children, it seems to me that we are at the moment too deficient in accurate information to predict just how effective these antibiotics would be in treating adults, especially in the event that the hemophilus was acting concomitantly with influenza virus. In the light of such possible therapeutic uncertainties, I feel that primary reliance for protection against pandemic influenza should be placed on preventive rather than therapeutic procedures.

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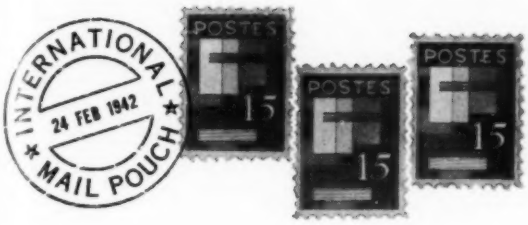


Milestone

All 70 sanitary inspectors of Costa Rica's Ministry of Public Health, studying in 3 groups, completed a 7-month course of classroom instruction and field demonstration introduced November 1954. Spanish language resumés of the various subjects, developed by Alberto Grego, sanitarian, helped make the training one of the more successful projects of the Cooperative Public Health Servicio.

The best three students from each group were sent to Puerto Rico for training in supervision. They will become a nucleus of supervisors to strengthen and improve the service of the section of sanitary inspection.

—CHARLES S. PINEO, *chief, health, welfare and housing field party, U. S. Operations Mission, Costa Rica.*

15th Anniversary

Serviço Especial de Saúde Pública completed 15 years of public health work in Brazil last July. Wherever SESP operates, festivities, speeches, and exhibits marked the anniversary of this cooperative health program.

Begun as emergency health work in the Amazon Valley supporting production of strategic materials during World War II, SESP has now spread over the entire country, operating in 461 localities. It is best known for its community health programs and water supply work.

About 1 million people a year receive some kind of direct service at SESP health units and at least another million are reached by home visitors, sanitary inspectors, and health educators. Eleven regional offices throughout the country direct the program of medical care, maternal and child health service, and environmental sanitation.

Five hundred water supply projects are already operating or under construction or being designed. A result of these projects, according to Professor Herbert M. Bosch: "The development, largely through SESP efforts, of a full-time sanitary engineering specialty in Brazil over a period of 15 years is, I believe, without precedent in the world."

SESP is presently strengthening state and local government agencies to carry out health and sanitation work delegated to them by Brazil's constitution.

—E. Ross JENNEY, M.D., *chief, Health and Sanitation Division, U. S. Operations Mission, Brazil.*

Earthquake in Ardestan

A woman sat on a mound of rubble that had once been her home, guarding her pots and pans and refusing to move. Then the Iranian nurse spoke to her gently and the gendarme led her away. A wall fell on a man while he slept in bed. A woman and her four children were found under the rubble in a home.

They were victims of an earthquake in Ardestan, Iran, last April. In 1 of the 7 villages hit, more than 250 houses were destroyed or damaged beyond occupancy. The disaster taxed the public health services staff but they worked tirelessly.

The injured were in a temporary hospital building. There nurses removed cotton placed over dirty wounds, cleaned them, and put on fresh dressings. A woman with bilateral leg fractures was taken by gendarme ambulance to Isfahan.

At the quake site, public health workers pitched a tent, set up priorities for treatment, and gave medical care. Patients swarmed in with ailments ranging from worms to skin diseases.

—GLEN W. MCDONALD, M.D., M.P.H., *chief, Public Health Division, U. S. Operations Mission, Iran.*

Vanishing Yaws

Inspectors making their 11th house-to-house survey in the province of Esmeraldas, Ecuador, found yaws disappearing. Esmeraldas, a town of 20,000, had only 5 cases, 2 of them relapses, and Quinindé, with a population of 1,100 yielded only 6 cases, 5 of them relapses. Activities were intensified to find and treat all residual cases. The inaccessibility of isolated communities in northwest Ecuador makes this the most difficult phase of the anti-yaws campaign.

—JAMES D. CALDWELL, *chief, health, welfare and housing field party, U. S. Operations Mission, Ecuador.*

Opportunities in the United States Public Health Service, a 27-foot floor model, is one of the first Public Health Service exhibits under the expanded recruitment program. It won a Certificate of Merit from the Committee on Scientific Exhibits during the 1955 meeting of the American Public Health Association. The box protruding from the center surface of the exhibit contains a motion picture projector for continuous showing of the recruitment filmograph "Service With Distinction."

Visual Aids for PHS Recruitment

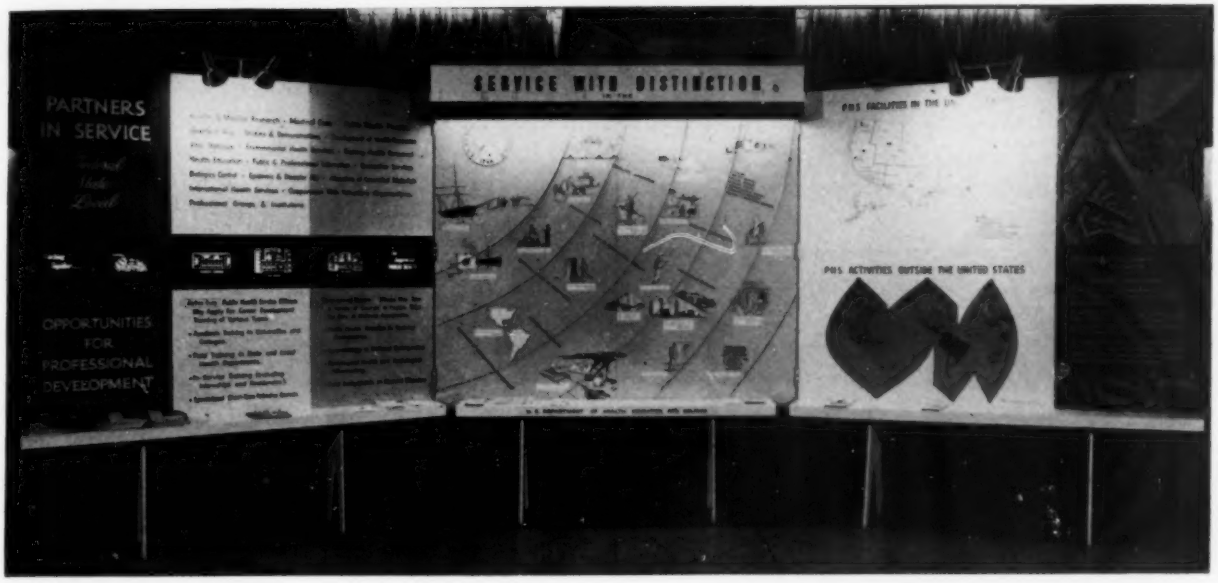
At a time when the Nation is experiencing a shortage of qualified technical, professional, and scientific personnel, the Public Health Service, principally through its Division of Personnel, is developing and expanding a recruitment program for commissioned and civil service personnel to meet its own needs for specialists. Filmographs and exhibits produced by the Service are described here as examples of the types of materials being developed for the recruitment program.

FILMOGRAPHS

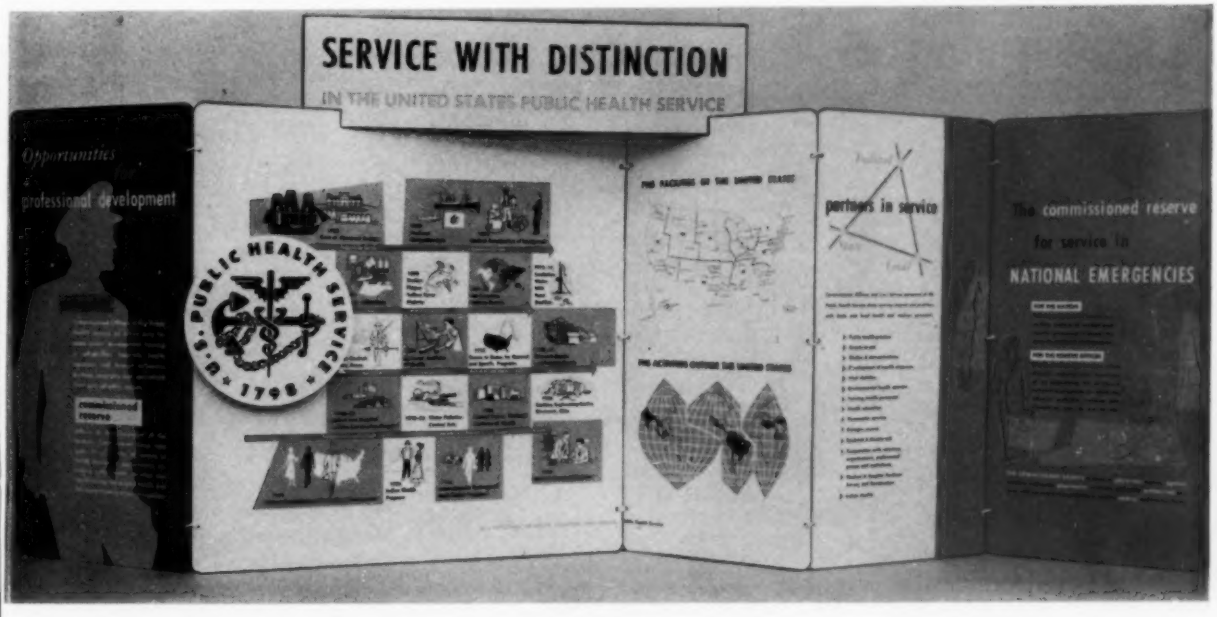
A black and white, 16-mm. filmograph, produced primarily to recruit professional and technical personnel for the Public Health Service Commissioned Corps, is being revised and converted to color and will be ready by next spring. It bears the title "Service with Distinction" and was described in the July 1956 issue of *Public Health Reports*, shortly after it was originally produced. The black-and-white version has been shown to numerous health, medical, and nursing groups, as well as lay organizations, universities, and professional schools, throughout the country in the past 2 years. It is available, in black and white, also as a filmstrip, accompanied by recorded narration and music.

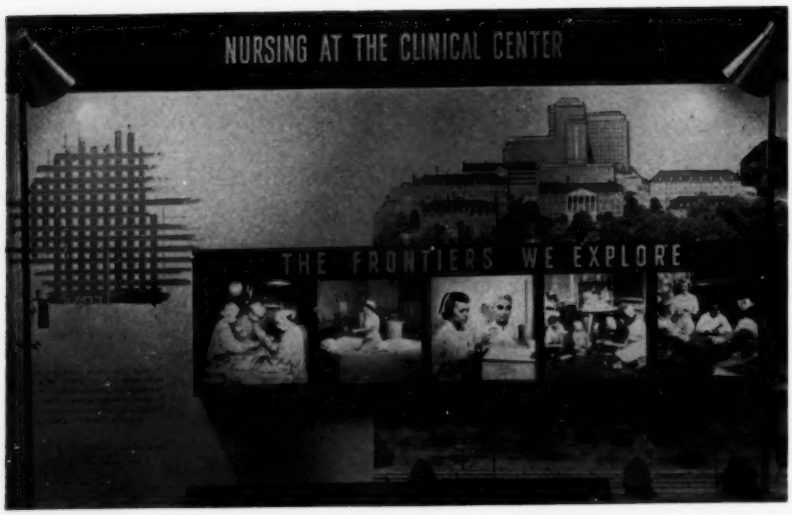
A 16-mm. filmograph in color, entitled "For the Nation's Health," was released recently by the Service. Although produced primarily for the orientation of Service employees, "For the Nation's Health" will be of interest also to health and medical personnel, students in professional schools, parents, teachers, counselors, and comunity groups. It describes the origin, growth, organization, and work of the Service in nontechnical terms and provides the viewer with a clear understanding of the scope of its work. (See film announcement on page 164.)

Also new is the Service's nurse recruitment filmograph "Anyone For Nursing?" a 16-mm. production in color that is directed toward the recruitment of nurses in some of the Service's more interesting and challenging programs. Paced with sprightly music and humorous cartoons, it takes the viewer on a tour of the Public Health Service programs in which nurses are most active. These include the Public Health Service hospitals throughout the country, the clinical research programs of the National Institutes of Health, the Indian health pro-

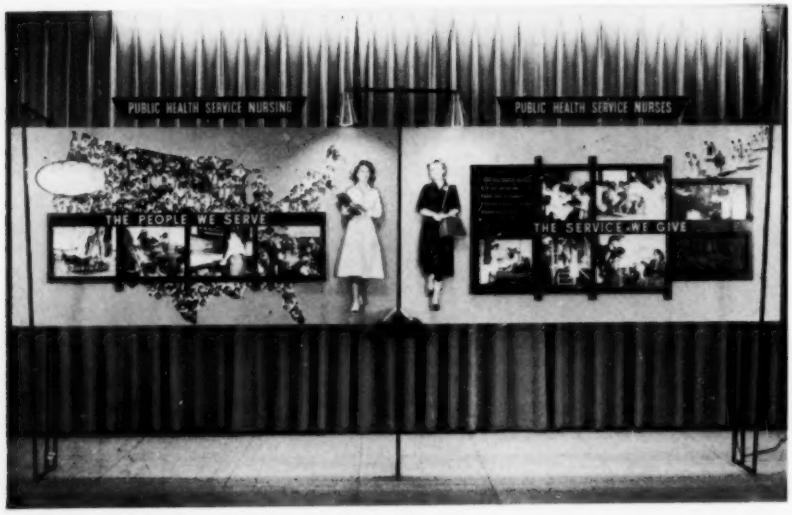

PARTNERS IN SERVICE
SERVICE WITH DISTINCTION
OPPORTUNITIES FOR PROFESSIONAL DEVELOPMENT
PHS ACTIVITIES OUTSIDE THE UNITED STATES

Service With Distinction, a new series of recruitment exhibits, includes a 17-foot floor model (above), a mounted projection box containing a motion picture projector for continuous showing of films (right), and a 7-foot table-top display (below). Other exhibits with the same theme (not illustrated) are a 9-foot combination floor and table-top exhibit made of aluminum with detachable legs and a 12-foot floor model composed of four aluminum panels, colorfully designed and well illuminated.

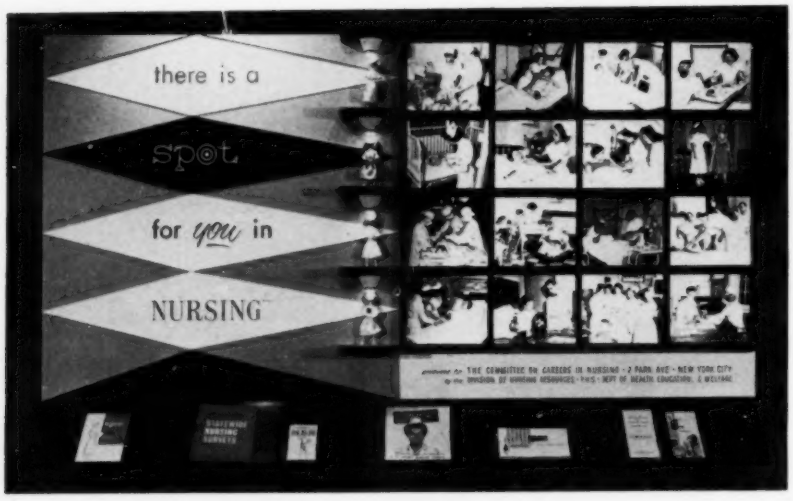

SERVICE WITH DISTINCTION
IN THE UNITED STATES PUBLIC HEALTH SERVICE
Opportunities for professional development
commissioned reserve
U.S. PUBLIC HEALTH SERVICE 1798
partners in service
The commissioned reserve for service in NATIONAL EMERGENCIES



The Frontiers We Explore



The People We Serve . . . The Service We Give



There's a Spot for You in Nursing

gram in this country and Alaska, public health nursing activities, and the overseas health missions. Nurses are shown at work in the West, in the frontier environment of the sub-Arctic, and in foreign lands. (See film announcement in January 1958 issue, page 7.)

GENERAL EXHIBITS

Among the first recruitment exhibits produced by the Division of Personnel are a table-top model and a 27-foot prize-winning floor model entitled "Opportunities in the United States Public Health Service" (see illustration). The four-panel table-top model stands 32 inches high and is approximately 8 feet long when set up for display.

Recently completed by the Division is a series of exhibits each bearing the title "Service With Distinction," the keynote of the recruitment drive. Each exhibit in this series describes Federal-State-local health program relationships, opportunities for professional training in the Service, the growth and development of the Service since 1798, and the scope and variety of Service facilities and programs in this country and overseas (see illustration). Special mention is made of the Service's Commissioned Reserve program, through which a national reserve of health and medical personnel is being organized, expanded, and trained for national emergencies.

The "Service With Distinction" series consists of two 17-foot floor exhibits, two 12-foot floor models, a 9-foot combination floor and table-top model, 40 table-top models, and 1,000 miniature counter-top displays. In addition, there is a refurbished film projection box, mounted on aluminum legs and bearing the theme title, for continuous showing of films at meetings. This unit also has a shelf for display of literature.

SPECIAL EXHIBITS

A number of programs in the Public Health Service are concerned with shortages of specific professional personnel. The following exhibits tailored to their needs have also been produced.

The Frontiers We Explore displays scenes illustrating opportunities for clinical nursing in the Public Health Service's National Institutes of Health, Bethesda, Md. (8 feet, floor model).

The People We Serve . . . The Service We Give, produced by the Division of Nursing Resources, depicts nursing opportunities throughout the Service (16 feet, floor model).

There's a Spot for You in Nursing, produced by the Division of Nursing Resources for the Committee on Careers of the National League for Nursing, illustrates nursing opportunities for nursing aides, practical nurses, professional nurses, and teachers, supervisors, and administrators (8 feet, floor model; 5 feet, table-top model).

Opportunities for Nurses, produced by the Division of Personnel, is designed to recruit nurses to meet needs throughout the Service (four panels of aluminum, each 30 inches high by 18 inches wide, portable table-top model; three models in use).

Indian Health Service Nursing . . . The Challenge We Meet, produced by the Division of Indian Health, shows how nurses in the Indian health program accept the challenge of providing hospital and public health services for 370,000 Indians and Alaskan natives (8 feet, floor model).

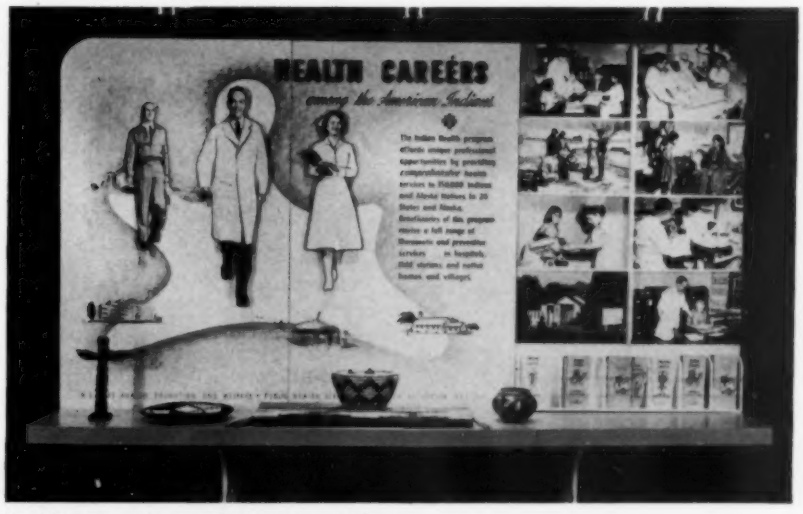
Sanitation Services for Indians . . . The Challenge We Meet, a new exhibit created by changing the headboard and photographs in the above display, depicts the Indian health activities of sanitary engineers (8 feet, floor model).

Health Careers Among the American Indians, designed by the Division of Indian Health, aims to interest professional personnel in the full range of therapeutic and preventive services provided by the Indian health program (9 feet, folding floor model).

A New Approach to Indian Health, created by the Division of Indian Health, describes opportunities for professional personnel to work with other disciplines in the Indian health program (12 feet, floor model).

Opportunities for Nurses

Indian Health Service Nursing . . . The Challenge We Meet



Health Careers Among the American Indians

The Research Patient depicts activities of personnel staffing the supporting professional services in the Clinical Center, National Institutes of Health, Bethesda, Md. Photographs show how the research dietitian, research nurse, research social worker, and research therapist work together for the benefit of the research patient and, ultimately, of medical science (18 feet, floor model).

Opportunities for Engineers and Scientists was produced by the Division of Personnel, with the assistance of the Division of Sanitary Engineering Services, for recruitment of sanitary engineers, nuclear physicists, public health engineers, chemists and biologists, civil and other engineers, and sanitarians (four panels of pressed wood, each 2 feet high by 3 feet wide, portable tabletop model; 20 models in use).

These Public Health Service recruitment films and exhibits have been in wide circulation at professional meetings during the past winter. Inquiries about availability may be directed to the Surgeon General, U. S. Public Health Service (P), Washington 25, D. C.

NATIONAL HEALTH COUNCIL FILM

The need for recruiting manpower for health careers has also been recognized by many voluntary agencies. An example is the 15-minute documentary film entitled "Health Careers," produced by the National Health Council as part of its Health Careers Horizons project. Like the Council's well-known publication, Health Careers Guidebook, this film is designed to interest young people in entering the health professions. It is a black and white 16-mm. film with sound track.

The film was developed with the guidance of 20 consultants representing secondary education and school counseling services for presentation to teen-agers, parents, counselors, teachers, and community groups. Inquiries about the film should be directed to Health Careers, National Health Council, 1790 Broadway, New York 19, N. Y.

A New Approach to Indian Health

The Research Patient

Opportunities for Engineers and Scientists

Health Insurance Coverage for Mental Illness

LOUIS S. REED, Ph.D.

TODAY in the United States approximately 116 million people have some health insurance coverage for hospital care: 101 million, for surgical service; 65 million, for medical service in the hospital; and 9 million, for physician service in the office, clinic, and home. Major health insurance carriers are the Blue Cross and Blue Shield plans, insurance companies through group and individual policies, and independent plans. The last type includes company and union self-insured plans, community-sponsored plans, and prepayment programs offered by private medical groups. Table 1 shows the number of persons covered for the various services by each type of plan.

Prepayment plans generally provide less extensive coverage for mental illness than for other types of illness. In part at least, this is due to the long duration of mental illness, to the fact that mental illness has traditionally been considered as separate and apart from other illness, and to the fact that much of the hospitalization for mental illness is provided in government hospitals at little or no cost to the patient or his family.

The lesser coverage for mental illness creates problems for the subscribing public, for hospitals, and for the medical profession in general and psychiatrists in particular. To elucidate the present situation as regards coverage, I shall describe in turn the practices of each type of plan.

Blue Cross Plans

Most of the 80 Blue Cross plans in the United States offer two or more, and some a whole host of, subscriber contracts with varying provisions regarding duration of benefits, type of room or amount of room allowances, and the like. Some provide better coverage of mental and nervous cases (the terminology generally used by the plans) under one contract than under another. I shall deal only with the most extensive contracts of each plan.

The plans provide far less extensive coverage of mental illness than of other types of illness in general hospitals, and they provide far less extensive coverage of mental illness in mental than in general hospitals (table 2). The majority of the plans provide a maximum of between 60 and 120 days of care, generally per admission, for general illness. By contrast, 18 of the 80 plans provide no coverage whatever of mental and nervous cases in general hospitals, 3 provide coverage only until diagnosis as a mental case, and 1 covers for shock therapy or surgery only. Of the remaining plans, 8 provide 7 to 20 days of coverage, and 27, or about a third, between 21 and 30 days. Only 16

Dr. Reed is associate professor of medical economics, Sloan Institute of Hospital Administration, Cornell University. Long interested in the economics of medical care and prepayment plans, he made a nationwide survey of Blue Cross and related medical service plans in 1944–47. A paper on employee health benefit plans by Dr. Reed was published in the December 1957 issue of Public Health Reports. The present paper is based on one he delivered at the annual meeting of the American Psychiatric Association on May 14, 1957, in Chicago, Ill.

Table 1. Health insurance coverage in the United States, by type of coverage, according to type of carrier, Dec. 31, 1956

[Thousands of persons covered]

Type of carrier	Type of coverage					
	Hospital care	Surgical service	Medical service in—		Supplementary major medical policies	Comprehensive medical expense policies
			Hospital	Office and home		
Blue Cross-Blue Shield and other plans sponsored by medical societies	53, 162	42, 570	33, 907	3, 000	(1)	0
Insurance companies:						
Group policies	45, 211	45, 906	25, 177	2, 000	6, 872	1, 413
Individual policies	27, 629	23, 074	6, 789	500	587	0
Independent plans	4, 654	4, 909	5, 276	3, 500	0	0
Gross total	130, 656	116, 459	71, 149	9, 000	7, 459	1, 413
Deduction for duplicate coverage	14, 707	15, 134	6, 258	300	0	0
Net total	115, 949	101, 325	64, 891	8, 700	[1] 7, 459	1, 413

[1] A fair number of the Blue Cross-Blue Shield plans have "dread disease" or "prolonged illness" supplementary contracts or riders which offer a coverage somewhat analogous to the major medical expense policies of insurance companies. Also, a few plans have issued major medical contracts. The number of persons covered under these supplementary Blue Cross-Blue Shield contracts is not known; it is probably in excess of 4 million.

SOURCE: Data in all columns except "Medical service in office and home" are from the Health Insurance Council's The Extent of Voluntary Health Insurance Coverage in the United States as of December 31, 1956. Data in that column are my own rough estimates. The presentation of the data differs somewhat from that in the council's publication.

of the plans provide as many as 60 days of coverage in general hospitals. A few of the plans further limit coverage for mental illness by specifying that the prescribed number of days for mental care shall be the total provided during the lifetime of the member.

So far as I can calculate, approximately 30 percent of the plans provide the same coverage for mental cases in general hospitals as they provide for general illness; the remainder provide less or no coverage.

The coverage provided in mental hospitals is still less extensive. Almost half of the plans provide no coverage whatever; 3 cover only until diagnosis as a mental case; 1 covers for shock therapy or surgery only; 5 provide less than 21 days; 23, between 21 and 30 days; and only 10, more than 30 days. In a number of the plans these days are the maximum provided for life. Two plans exclude all care in government hospitals, and several exclude care available without charge in government hospitals. These provisions indicate that there is some question as to whether the State mental hospitals of the area charge for their services or not.

Several plans provide extensive coverage for mental cases. One provides up to 120 days per admission in either general or mental hospitals. Three of the plans offer special riders to their regular policies which provide an extra coverage of mental cases. Two of these, one at a cost of 12 cents and another at 15 cents a month for a family, provide up to 30 days for mental cases in either general or mental hospitals. The third, at a cost of 10 cents a month for a family, will extend the coverage for mental cases from the 30 days available under its ordinary certificate to 120 days in either general or mental hospitals.

The provisions of the plans regarding alcoholism, drug addiction, and self-inflicted injuries (attempts at suicide) are pertinent here. About two-thirds of the plans provide some coverage for alcoholism and for drug addiction, and almost all cover self-inflicted injuries (table 3).

Blue Cross coverage of mental illness has distinctly improved over the past decade. Ten years ago half of the plans excluded all coverage even in general hospitals, and only 5 out of

31 plans provided benefits in general hospitals for as long as 31 days.

Blue Shield Plans

Of the 64 Blue Shield plans, 4 provide only surgical service, 51 cover surgical and inhospital medical service, and 9, under at least one of their contracts, also cover physicians' services in the office and home.

Thirty-three, or a few more than half, of the plans cover mental and nervous conditions on the same basis as all other conditions; 21 totally exclude these conditions; and the remaining 10 provide limited coverage (table 4). Mostly these last limit care to less than 30 days or to that provided in general hospitals.

Special interest attaches to the nine plans which offer comprehensive coverage of physicians' services, that is, care in the office, home, and hospital. Of these, 4 provide the same coverage for mental and nervous conditions as for other conditions; 1 totally excludes these conditions; 1 covers only shock treatments or surgery; 1 covers only diagnosis in the office; 1 excepts psychiatric treatment; and 1 provides coverage for only 30 days.

About two-thirds of all Blue Shield plans provide some coverage of alcoholism and drug addiction, and the great majority cover self-inflicted injuries (table 4).

Table 2. Blue Cross coverage for general conditions and for mental conditions in general and mental hospitals, January 1957: number of plans providing specified days under most extensive contract

Days of full-benefit care per admission or per year	General conditions	Mental conditions	
		General hospitals [1]	Mental hospitals [2]
No coverage	0	18	38
Until diagnosed	0	3	3
For shock therapy and surgery only	0	1	1
1–10	0	4	3
11–20	0	4	2
21–30	8	27	[3] 23
31–60	7	[3] 7	4
61–90	22	3	3
91–120	31	[3] 9	[3] 3
121–180	3	2	0
181–365	4	0	0
366–730	4	1	0
731–850	1	[4] 1	0
Total	80	80	80

[1] 9 plans provide the specified days as a maximum during life of member.
[2] 8 plans provide the specified days as a maximum during life of member.
[3] 1 excludes care in all government hospitals.
[4] In acute general hospitals only.

SOURCE: Compiled from data in Blue Cross Guide, January 1957.

Table 3. Blue Cross coverage of alcoholism, drug addiction, and self-inflicted injuries, January 1957: number of plans with designated provision under most extensive contract

Provision	Alcoholism	Drug addiction	Self-inflicted injuries
Not covered	29	26	6
Covered until diagnosed	1	1	1
Covered on same terms as general conditions	17	23	63
Covered but in participating or general hospitals only	13	10	3
Covered in all types of hospitals but for fewer days than other cases:			
Less than 20 days	4	4	0
20–31 days	10	8	0
Covered but in participating or general hospitals only, and for fewer days than other cases:			
Less than 20 days	1	1	0
20–31 days	2	2	4
More than 32 days	0	1	0
Covered in participating or general hospitals and for limited periods in other hospitals	2	1	1
Other provisions [1]	1	3	2
Total	80	80	80

[1] Mainly covered in general hospitals but not in specified types of government hospitals.

SOURCE: Compiled from data in Blue Cross Guide, January 1957.

Insurance Companies

I shall deal first with group policies and then with individual policies.

Group insurance plans sold by insurance companies generally provide hospitalization coverage for 31 days or 70 days, occasionally for 120 days, and rarely for 180 days. With rare exceptions, these policies provide the same coverage for mental illness, alcoholism, drug addiction, and self-inflicted injuries as for all other

types of cases, and without distinction as to type of hospital.

Group surgical and inhospital medical policies of insurance companies likewise usually cover these cases on the same terms as all other types of cases.

Most companies also sell group policies providing coverage of medical calls in the office and home, usually on a 2- or 3-visit deductible basis. In general these plans cover mental or nervous conditions; however, most are written with the condition that, for the employee, benefits will be paid only if he is disabled.

Within the past 6 years there has been a rapid growth of a type of insurance known as major medical expense insurance, written mainly on a group basis. This insurance supplements the basic hospital, surgical, and medical coverages and usually pays 75 percent of all medical care expense beyond the benefits under the basic coverages and a deductible amount paid by the insured. Within the past 3 years there has been a rapid growth of another type of insurance, called comprehensive medical expense insurance. These policies combine the basic and major medical coverages into a single package. They pay 75 to 85 percent of virtually all medical costs over specified initial deductible amounts and up to high maximum limits.

The practices under these policies in covering mental cases vary. Some policies cover mental illness on the same terms as all other illness. Other plans do this with the proviso that if the employee is not disabled or the dependent hospitalized the rate of reimbursement of expense for psychiatric treatment or consultations will be 50 percent instead of the usual 75 to 85 percent. Still other plans provide reimbursement in mental illness only for patients who are totally disabled or confined in a hospital.

Most of the major medical or comprehensive policies are rather new, and thus experience has been limited. Quite possibly the companies have not yet come fully to grips with the problems of providing care economically and at reasonable costs. In a letter to the author, one large company writes:

"The broad coverage [of mental illness now provided] may be of short duration. In one particular group policy . . . the claims for

Table 4. Blue Shield coverage of mental and nervous conditions, alcoholism, drug addiction, and self-inflicted injuries, March 1957: number of plans with indicated provision

Provision	Nervous and mental conditions	Alcoholism	Drug addiction	Self-inflicted injuries
Covers [1]	33	35	38	54
Excludes	21	25	22	10
Limited coverage	[2] 10	[3] 4	[3] 4	0
Total	64	64	64	64

[1] To the same extent as other types of cases.
[2] 5 cover for a limited period, from 10 to 30 days; 2 cover only in general hospitals; 1 covers for shock therapy only; 1 covers for diagnosis only, and 1 covers except for psychiatric treatment.
[3] 2 cover only in general hospitals; 1 covers for 30 days only; and 1 covers except for psychiatric treatment.

SOURCE: Compiled from data in Blue Shield Manual, as revised to March 1957.

treatment of mental or nervous conditions amounted to well over one-third of the total claims, exclusive of maternity claims. The psychiatric charges at the beginning . . . were in the $20 and $25 bracket and the frequency was averaging between 1 and 2 treatments a week. Gradually the charges increased to $30 a visit and the frequency to 6 times per week with no disability . . . involved.

"Obviously if we are to continue the broad coverage contemplated we must have some pattern which will show an insurable risk—a risk that we can measure and for which we can establish a premium."

Health insurance policies sold to individuals vary perhaps even more widely than group policies, and some companies issue a multitude of different policies with different provisions. Data on number of persons covered under the different provisions are not available. My impression is that the majority of policies exclude mental illness.

Independent Plans

Some of the independent plans are doing interesting experimentation in the coverage of mental illness.

The medical program of the United Mine Workers Welfare and Retirement Fund will

pay for care of patients with mental illness in general hospitals and will provide virtually unlimited care by psychiatrists in the office or outpatient department, to the extent such services are deemed essential. It pays for care in mental hospitals only when the prospect is that the patient will respond to care in a relatively short period, say 1 or 2 months.

The Health Insurance Plan of Greater New York, which provides service through medical groups, excludes alcoholism, drug addiction, and "coverage for psychiatric disorders after diagnosis, for which care is customarily provided by a psychiatrist." Each medical group is required to have a board-certified psychiatrist. The physicians in the group refer patients to him for diagnosis, and in establishing a diagnosis there is usually some form of treatment. However, the groups do not provide shock therapy or analysis. Visits to psychiatrists-neurologists amount to ½ of 1 percent of the total number of services provided by all group physicians to members of the plan.

The Kaiser Foundation Health Plan, which provides services through its own medical groups and hospitals, excludes care for mental illnesses or disorders, attempts at suicide, and alcoholism. However, two of the larger medical centers now have psychiatric clinics. These provide testing and therapy at low fees, usually $5 an hour. The personnel at one clinic includes 2 full-time and 1 part-time psychiatrist, 4 psychologists, and 2 psychiatric social workers. The extra fees charged subscribers do not pay the full expenses of the clinic, which is subsidized by the program as a whole. The program is reported to be very useful in relieving other services of chronic patients whose illnesses are more psychological than somatic.

Group Health Association in Washington, D. C., excludes psychiatric treatment. However, the staff includes two part-time psychologists who provide counseling service to subscribers at a charge of $7 an hour.

The St. Louis Labor Health Institute provides psychiatric service. The staff includes 3 psychiatrists and 1 clinical psychologist, whose hours of service represent about 3 percent of the total of all physician hours.

Most of the large union health centers have part-time psychiatrists on their staffs. Psychiatric visits tend to be about 1 or 2 percent of all visits.

These examples will suffice to indicate practices of independent plans. It is perhaps easier for plans which operate on group-practice principles to experiment with psychiatric coverage than it is for plans providing benefits through free-choice, fee-for-service arrangements.

Notes on Costs and Problems

A few figures may give some idea of the general magnitude of potential costs for coverage of hospitalization for patients with mental illness:

- At present about 2 percent of all patient-days in short-term general hospitals are for patients in the psychiatric units of these hospitals. This fact indicates that on the basis of prevailing practices full coverage of psychiatric cases in general hospitals should not increase a health insurance plan's costs by more than 2 percent.
- If prepayment plans undertook responsibility for the first 60 days of all admissions to all mental hospitals, including State institutions, and provided an average of 45 days per admission, they would assume liability for days of care amounting to an additional 10 percent of all days for general care. Since the cost per day in mental hospitals is, of course, lower than for general hospitals, this would represent less than a 10 percent increase in costs.
- One Blue Cross plan which covers mental cases for 120 days in general hospitals and for 30 days in other hospitals reports that its payments for mental, psychoneurotic, and personality disorder cases amount to 3.2 percent of its total inpatient payments. An insurance company estimates that under its basic hospitalization plans 3 to 5 percent of its hospital expense is for psychoneurotic disorders.

Among the problems in providing coverage for mental illness are the costs, in a setting where all types of plans are finding their costs expanding; the indeterminateness of these costs particularly when care over a long period in a hospital or physician's office is required; the question of how mental hospitals in this country should be financed and of demarcation of

the respective roles of patients, private insurance, and government in financing mental hospital care. All real coverage of psychiatric care in the office must await the development of prepayment for physicians' services generally in the office and home, a field in which experimentation and pioneering are the order of the day.

A quotation from a letter I received from the director of one independent prepayment plan may well sum up the present position of prepayment plans and insurance carriers on coverage for psychiatric care:

"It seems to me that the most important fact is that no one has any idea as to what the utilization of complete psychiatric services would be if they were available on an insured basis. It is our hope, therefore, to extend coverage in this field bit by bit so as to learn as we go along, while avoiding too great a risk."

National Health Survey Advisory Committee

To enhance the usefulness of the U. S. National Health Survey of the Public Health Service, an advisory committee has been set up to include representatives of the health professions, insurance firms, labor, and other users of health statistics.

The new committee will review the plans and progress of the survey and help formulate principles and methods of cooperation with interested public and private organizations.

Leroy E. Burney, Surgeon General of the Public Health Service, is chairman of the committee, and George St.J. Perrott, chief of the Service's Division of Public Health Methods, serves as executive secretary.

The committee held its first meeting November 22, 1957.

Members of the committee are: Dr. Karl Bambach, vice president, American Drug Manufacturers Association, Washington, D. C.; Dr. Leona Baumgartner, commissioner of health, New York City; Pearl Bierman, medical care consultant, American Public Welfare Association, Chicago, Ill.; Dr. Paul E. Boyle, dean, School of Dentistry, Western Reserve University, Cleveland, Ohio; James Brindle, director, Social Security Department, United Auto Workers, Detroit; Arthur M. Browning, vice president, New York Life Insurance Co., New York City; Dr. W. D. Bryant, executive director, Community Studies, Inc., Kansas City, Mo.

Other members are: Dr. Bernard Bucove, State director of health, Olympia, Wash.; Dr. Robin C. Buerki, executive director, Henry Ford Hospital, Detroit; George Bugbee, president, Health Information Foundation, New York City; Dr. Antonio Ciocco, head, Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh; James F. Coleman, president, United Medical Service, Inc., New York City; Dr. J. S. Denslow, professor and director of research affairs, Kirksville College of Osteopathy and Surgery, Kirksville, Mo.; Dr. Robert P. Fischelis, secretary, American Pharmaceutical Association, Washington, D. C.

Also on the committee are: Dr. Norvin C. Kiefer, chief medical director, The Equitable Life Assurance Society of the United States, New York City; Dr. Allister M. Macmillan, Department of Sociology and Anthropology, Cornell University, Ithaca, N. Y.; Dr. Ross A. McFarland, Department of Industrial Hygiene, School of Public Health, Harvard University, Boston; Dr. H. B. Mulholland, Department of Internal Medicine, School of Medicine, University of Virginia, Charlottesville; Dr. Peter M. Murray, board of trustees, State University of New York, Albany.

Completing the list of members are: Marian G. Randall, R.N., executive director, Visiting Nurse Service of New York; Dr. Vergil D. Reed, vice president, J. Walter Thompson Co., New York City; Dr. James H. Sterner, medical director, Eastman Kodak Company, Rochester, N. Y.; James E. Stuart, executive director, Hospital Care Corporation, Cincinnati, Ohio; and Dr. Ray E. Trussell, executive officer, School of Public Health and Administrative Medicine, Columbia University, New York City.

publications

Cost Analysis for Collegiate Programs In Nursing

Part I. Analysis of expenditures
Part II. Current income and other resources

National League for Nursing and PHS Publication. By Leslie W. Knott, Ellwynne M. Vreeland, and Marjorie Gooch. Part I, 1956, 166 pages; $3.50. Part II, 1957, 46 pages; $2.00.

Although these manuals are focused on analyzing costs of nursing education, the techniques and methods described should prove useful for other types of education programs.

Part I contains a general discussion of underlying principles, defines terms, and describes the methods used. Part II, in addition to discussing the usual sources of education income, includes suggested methods for evaluating student service.

Schedule forms for organizing and anaylzing cost information are presented with illustrative data based on a fictitious university carried through the analysis step by step.

Copies can be obtained from the National League for Nursing, 2 Park Avenue, New York 16, New York.

Reported Tuberculosis Data, Calendar Year 1955

PHS Publication No. 560. 1957. By Stanley Glaser and Paul L. Roney. 29 pages. 25 cents.

This fourth annual summary presents data supplied to the Public Health Service on the Annual Tuberculosis Report by all the States, the District of Columbia, Alaska, Hawaii, and Puerto Rico.

The data cover newly reported tuberculosis cases for the United States and each State by source of morbidity report, activity status, form and extent of the disease, race, sex, and age, as well as X-ray case-finding activities, mortality, and public health nursing visits.

An analysis of each table summarizes data for the years 1952 through 1955 and points out pertinent characteristics inherent in the data.

Biological Products

PHS Publication No. 50. Revised April 15, 1957. 52 pages.

Superseding Public Health Service Publication No. 50, revised April 15, 1955, this edition lists the establishments holding licenses for the preparation and sale of viruses, serums, toxins and analogous products, and the trivalent organic arsenic compounds.

Comparative Mortality Among Metropolitan Areas of the United States, 1949–51

102 causes of death

PHS Publication No. 562. 1957. By Nicholas E. Manos. 143 pages. $3.25.

This graphic and tabular presentation of 1949–51 mortality, from 102 causes, in the United States includes ratios of observed to expected mortality for 163 metropolitan areas; mortality rates and ratios by degree of urbanization; and background material necessary to the interpretation of these data. It was prepared under the direction of the Air Pollution Medical Program, Public Health Service.

Mortality ratios are emphasized as a tool for comparative analysis, and mortality data are presented in greater geographic detail than has heretofore been available.

The 102 causes of death are grouped into 10 categories, including respiratory system diseases, circulatory system diseases, malignant neoplasms, and a group of miscellaneous diseases and conditions. Mortality comparisons from city to city, by cause, as well as comparisons between the central city and outlying areas of the 163 metropolitan areas, are shown.

While no analysis accompanies the statistics, the graphic form of presentation points up variations which suggest possible areas of research on the effects of environmental factors on mortality.

Meeting Community Sewage Treatment Needs Under the Construction Grants Program

PHS Publication No. 558. 1957. Folder.

The Federal grant program for construction of sewage treatment works, authorized under the Federal Water Pollution Control Act, Public Law 660, 84th Cong., is briefly described. Eligibility requirements and application procedures are outlined, and State water pollution control agencies cooperating with the Public Health Service in administering the program are listed.

Handbook of Selected Biological References on Water Pollution Control, Sewage Treatment, Water Treatment

Public Health Bibliography Series No. 8. PHS Publication No. 214. Revised 1957. By William Marcus Ingram. 95 pages; illustrated. 45 cents.

This revised handbook lists by subject numerous biological publications relating to various aspects of water pollution, waste treatment, and water supply that have appeared in recent technical literature. The references were selected on the basis

of their availability and potential usefulness to those not trained primarily in biology. The intent of the handbook is to provide information fundamental to a good understanding of biological problems that could arise in the course of water pollution control and related work.

A list of references on organism identification is included. Basic readings on ecology and water treatment are suggested in the introduction.

Facts About the Federal Water Pollution Control Act of 1956

PHS Publication No. 555. 1957. 16 pages. 15 cents.

Intended for community leaders, State and municipal officials, and others interested in control of water pollution, this booklet outlines briefly the provisions of the Federal Water Pollution Control Act of 1956 (Public Law 660, 84th Cong.) and the Public Health Service program authorized by the new law. Activities under this program include comprehensive program development, interstate cooperation, research and technical assistance, collection of basic data, State and interstate program grants, construction grants, and enforcement measures against interstate pollution.

Background information on earlier Federal legislation for pollution control is given, and the role which control of pollution plays in augmenting and conserving water resources to meet increasing demands is described.

How To Study Supervisor Activities in a Hospital Nursing Service

PHS Publication No. 496. 1957. By Elinor D. Stanford and others. 47 pages. 40 cents.

Third in a series developed by the Division of Nursing Resources, Public Health Service, for use by hospitals and others desiring to study nursing personnel activities, this manual provides the supervisor with a method for examining her actual activities in relation to the functions which she believes appropriate to her job. The steps in the study and the method of observation employed are described in detail.

Instructions for training observers and for tabulating material are included.

Directory of Full-Time Local Health Units, 1957

PHS Publication No. 118. Revised 1957. 70 pages. 30 cents.

This listing of full-time health units serving local areas, together with the name of the health officer of each unit or other designated administrative head, was revised July 1957. The local units are listed by State, giving in each instance the health area jurisdiction, post office address, and the health officer's name and official title.

Facts About Indian Health

PHS. Publication No. 479. Revised June 1957. 8 pages.

With up-to-date statistics and facts, this revised edition describes briefly the Indian health problem and the program of the Division of Indian Health, Public Health Service.

Socioeconomic Characteristics of Persons Who Married Between January 1947 and June 1954: United States

Vital Statistics—Special Reports. Selected Studies. Vol. 45, No. 12, Sept. 9, 1957. By Hugh Carter, Sarah Lewitt, and William F. Pratt. Pages 271–353; tables and charts. 45 cents.

Based on a sample survey of persons who married between January 1947 and mid-June 1954, data are given on residence at time of marriage as related to place of marriage, number of times previously widowed or previously divorced, number of times married, age at marriage, years of school completed, labor-force status of wife, and major industry group of husband.

There are cross tabulations of characteristics of the husband as related to those of the wife, as well as separate tabulations for husbands and wives. An analytical text, text tables, and charts precede 30 detailed tables of basic data.

The data were obtained through a special supplementary survey carried out by the Bureau of the Census in its current population survey. Tables of sampling errors are included.

Facts on Mental Health and Mental Illness

PHS Publication No. 543. 1957. 11 pages. 10 cents.

Known facts about mental illness are summarized and the need to know more is pointed out in this booklet. It shows the scope of the problem and cites new knowledge gleaned through recent research as well as progress made in the care, treatment, and rehabilitation of the mentally ill, and in the training of specialists in the mental health field. What is needed to solve this major health problem is outlined.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared by other Federal agencies.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications other than its own.

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